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FIVE-YEAR REVIEW REPORT FOR WYCKOFF/EAGLE HARBOR SUPERFUND SITE KITSAP COUNTY, WASHINGTON

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9/27/12

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TABLE OF CONTENTS

LIST OF ABBREVIATIONS vii

EXECUTIVE SUMMARY x

1. INTRODUCTION 18

1.1. PURPOSE OF THE REVIEW 18
1.2. AUTHORITY FOR CONDUCTING THE FIVE YEAR REVIEW 18
1.3. WHO CONDUCTED THE FIVE YEAR REVIEW 18
1.4. REVIEW STATUS 19

2. SITE CHRONOLOGY 19

3. BACKGROUND 26

3.1. PHYSICAL CHARACTERISTICS 26
3.2. LAND AND RESOURCE USE 26
3.2.2. Reasonably Anticipated Future Land Uses 27
3.3. HISTORY OF CONTAMINATION 27
3.4. INITIAL RESPONSE 28
3.5. BASIS FOR TAKING ACTION 29
3.5.1. Soil Operable Unit 30
3.5.2. Groundwater Operable Unit 31
3.5.3. West Harbor Operable Unit 32

4. REMEDIAL ACTION 34

4.1. SOIL AND GROUNDWATER OU 34
4.1.1. Remedy Selection 37
4.1.2. Remedy Implementation 38
4.2. WEST HARBOR 42
4.2.1. Remedy Selection 42
4.2.2. Remedy Implementation 43
4.2.3. System Operations/Operation and Maintenance 44
4.3. EAST HARBOR OU 44
4.3.1. Remedy Selection 44
4.3.2. Remedy Implementation 47
4.3.3. System Operations/Operation and Maintenance 49

5. PROGRESS SINCE LAST REVIEW 50

5.1. PROTECTIVENESS STATEMENTS FROM 2007 REVIEW 50
5.1.1. Soil and Groundwater OU 50
5.1.2. West Harbor OU 50
5.1.3. East Harbor OU 50
5.2. RECOMMENDATIONS AND STATUS FROM THE 2007 FIVE YEAR REVIEW 51
5.2.1. Overall Site (all OUs) 51
5.2.2. Soils and Groundwater OU 51
5.2.3. West Harbor OU 52

5.2.4. East Harbor OU *52*

6. FIVE YEAR REVIEW PROCESS **53**

6.1. ADMINISTRATIVE COMPONENTS, COMMUNITY NOTIFICATION, AND DOCUMENT REVIEW ..53
6.1.1. Administrative Components of the Five Year Review Process *53*
6.1.2. Community Notification and Involvement *53*
6.1.3. Document Review *54*
6.2. DATA REVIEW 54
6.2.1. Soils and Groundwater OU 54
6.2.2. West Harbor OU 56
6.2.3. East Harbor OU 63
6.3. SITE INSPECTION 69
6.4. INTERVIEWS 70

7. TECHNICAL ASSESSMENT **71**

7.1. QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS? 71
7.1.1. SOILS AND GROUNDWATER OU 71
7.1.1.1. Remedial Action and Performance *71*
7.1.1.2. Opportunities for Optimization *71*
7.1.1.3. Implementation of Institutional Controls *72*
7.1.1.4. Early Indicators of Potential Issues *72*
7.1.2. WEST HARBOR OU 73
7.1.2.1. Remedial Action Performance and Operations *73*
7.1.2.2. Opportunities for Optimization *73*
7.1.2.3. Implementation of Institutional Controls *73*
7.1.2.4. Early Indicators of Potential Issues *74*
7.2. EAST HARBOR OU 74
7.2.1. Remedial Action Performance and Operations *74*
7.2.2. Opportunities for Optimization *75*
7.2.3. Implementation of Institutional Controls *75*
7.2.4. Early Indicators of Potential Issues *76*
7.3. QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND RAOS USED AT THE TIME OF REMEDY SELECTION STILL VALID? 76
7.3.1. Exposure Assessment *76*
7.3.1.1. Soil and Groundwater OU 76
7.3.1.2. West Harbor OU 76
7.3.1.3. East Harbor OU 77
7.3.1.4. ATSDR Health Consultation 78
7.3.2. Ecological Risk *79*
7.3.2.1. Soil and Groundwater OU 79
7.3.2.2. West Harbor OU 79
7.3.2.3. East Harbor OU 79
7.3.3. Toxicity Assessment *81*
7.3.3.1. Soil and Groundwater OU 81
7.3.3.2. West Harbor OU 82
7.3.3.3. East Harbor OU 82
7.3.4. ARARs *83*

7.3.4.1. Soils and Groundwater OU 83
7.3.4.2. West Harbor OU 83
7.3.4.3. East Harbor OU 83
7.3.5. Progress Towards Meeting RAOs *84*
7.3.5.1. Soils and Groundwater OU 84
7.3.5.2. West Harbor OU 84
7.3.5.3. East Harbor OU 84
7.4. QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY? 84
7.4.1. Soils and Groundwater OU *84*
7.4.2. West Harbor OU *85*
7.4.3. East Harbor OU *85*
7.5. TECHNICAL ASSESSMENT SUMMARY 85
8. ISSUES, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS 87
9. PROTECTIVENESS SUMMARY 90
9.1. SOIL AND GROUNDWATER OU 90
9.2. WEST HARBOR OU 90
9.3. EAST HARBOR OU 90
10. NEXT REVIEW 91

TABLES

TABLE 1. SITE CHRONOLOGY 19
TABLE 2. SOIL CLEANUP LEVELS 35
TABLE 3. GROUNDWATER CLEANUP LEVELS [A] 36
TABLE 4. GROUNDWATER TREATMENT PLANT EFFLUENT DISCHARGE LIMITS 41
TABLE 5. SEDIMENT STANDARDS CHEMICAL CRITERIA 45
TABLE 6. SEDIMENT CLEANUP LEVELS - BIOLOGICAL CRITERIA 47
TABLE 7. SUMMARY OF THE WEST HARBOR 1997 OMMP MONITORING PERFORMANCE STANDARDS, PERFORMANCE OF MONITORING CONDUCTED IN YEARS 1 THROUGH 10 (1998 THROUGH 2007), AND THE 2008 OMMP MONITORING REQUIREMENTS (FROM HERRERA, 2008B). 58
TABLE 8. WEST HARBOR EXPOSURE PATHWAYS IN ROD 77
TABLE 9. SOIL AND GROUNDWATER OU CHANGES IN TOXICITY 81
TABLE 10. WEST HARBOR OU CHANGES IN TOXICITY 82
TABLE 11. SUMMARY OF ISSUES 87
TABLE 12. SUMMARY OF RECOMMENDATIONS AND FOLLOW-UP ACTIONS 88

FIGURES

FIGURE 1	SITE LOCATION AND OUS
FIGURE 2	SOIL AND GROUNDWATER OU COMPONENTS
FIGURE 3	SOIL AND GROUNDWATER OU SITE FEATURES AND MONITORING LOCATIONS
FIGURE 4	SOIL AND GROUNDWATER OU NEW TREATMENT PLANT AND EXTRACTION WELL LOCATIONS
FIGURE 5	SOIL AND GROUNDWATER OU PROCESS FLOW DIAGRAM OF NEW GROUNDWATER TREATMENT PLANT
FIGURE 6	WEST HARBOR OU SITE FEATURES AND MONITORING STATIONS
FIGURE 7	WEST HAROBR OU SEEP MONITORING STATIONS
FIGURE 8	EAST HARBOR OU CAP LOCATIONS
FIGURE 9	EAST HARBOR OU INTERTIDAL DESIGNATIONS
FIGURE 10	EAST HARBOR OU BATHYMETRY SOUNDING TRACKLINES
FIGURE 11	EAST HARBOR OU PHOTOGRAMMETRIC TOPOGRAPHIC SPOT ELEVATIONS
FIGURE 12	EAST HARBOR OU EBS COVER THICKNESS MONITORING LOCATIONS
FIGURE 13	EAST HARBOR OU INTERTIDAL CAP AND EBS SURFACE SEDMEINT SAMPLE LOCATIONS
FIGURE 14	EAST HARBOR OU NORTH SHOAL AND EAST BEACH INTERTIDAL SURFACE SEDIMENT AND SEEP SAMPLE LOCATIONS
FIGURE 15	EAST HARBOR OU EAST BEACH INTERTIDAL SUBSURFACE SEDIMENT SAMPLE LOCATIONS
FIGURE 16	EAST HARBOR OU SUBTIDAL CAP SURFACE SEDIMENT CHEMISTRY SAMPLE LOCATIONS
FIGURE 17	EAST HARBOR OU SUBTIDAL CAP SUBSURFACE SEDIMENT CHEMISTRY SAMPLE LOCATIONS
FIGURE 18	EAST HARBOR OU CLAM SURVEY LOCATIONS
FIGURE 19	EAST HARBOR OU BIRD AND MAMMAL VISUAL SURVEY LOCATIONS
FIGURE 20	EAST HARBOR OU FORAGE FISH BULK SAMPLING TRANSECTS WITHIN EBS AND INTERTIDAL CAP
FIGURE 21	EAST HARBOR OU INVERTEBRATE AND MACROALGAE SAMPLE LOCATIONS
FIGURE 22	EAST HARBOR OU EAGLE HARBOR ELEVATION CHANGES FROM 1999 TO 2011

FIGURE 23 EAST HARBOR OU EAGLE HARBOR ELEVATION DIFFERENCES FROM 1999 TO 2005

FIGURE 24 EAST HARBOR OU EAGLE HARBOR ELEVATION DIFFERENCES FROM 2005 TO 2011

FIGURE 25 EAST HARBOR OU SUBTIDAL CAP SURFACE SEDIMENT RESULTS

FIGURE 26 EAST HARBOR OU SUBTIDAL CAP SUBSURFACE SEDIMENT RESULTS

FIGURE 27 EAST HARBOR OU GRIDS J-9 AND J-10 RESULTS

FIGURE 28 EAST HARBOR OU EXPOSURE BARRIER SYSTEM ELEVATION DIFFERENCE FROM 2008 TO 2011

FIGURE 29 EAST HARBOR OU EXPOSURE BARRIER SYSTEM COVER THICKNESS

FIGURE 30 EAST HARBOR OU NORTH SHOAL AND EAST BEACH SURFACE SEDIMENT RESULTS

FIGURE 31 EAST HARBOR OU EAST BEACH SUBSURFACE SEDIMENT RESULTS

APPENDICES

APPENDIX A DOCUMENTS REVIEWED

APPENDIX B SITE INSPECTION CHECKLISTS

APPENDIX C SITE INSPECTION PHOTOGRAPHS

APPENDIX D INTERVIEW TRANSCRIPTS

APPENDIX E DATA

APPENDIX F PUBLIC NOTICE

APPENDIX G COMMENTS RECEIVED FROM SUPPORT AGENCIES AND/OR THE COMMUNITY

APPENDIX H TITLE SEARCH REVIEW REPORT

APPENDIX I ARAR ANALYSIS

LIST OF ABBREVIATIONS

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirements
ATSDR	Agency for Toxic Substances and Disease Registry
BMP	Best Management Practices
BNA	Base/neutral and acid extractable
CDF	Confined Disposal Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLARC	Cleanup Levels and Risk Calculations
cPAH	carcinogenic polycyclic aromatic hydrocarbon
COC	Chemical of Concern
CY	cubic yards
DAF	Dissolved Air Floatation
DNAPL	Dense Non-Aqueous Phase Liquid
DOT	Washington State Department of Transportation
EBS	Exposure Barrier System
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERA	Expedited Response Action
ESA	Endangered Species Act
ESD	Explanation of Significant Difference
FFS	Focused Feasibility Study
FS	Feasibility Study
FYR	Five-Year Review
GAC	granular activated carbon
gpm	gallons per minute
GRE	Generational Remedy Evaluation
GWTP	groundwater treatment plant
HH	Human health
HHRA	Human Health Risk Assessment
HPAH	High Molecular Weight Polycyclic Aromatic Hydrocarbons
IRIS	Integrated Risk Information System
LAET	Lower Apparent Effects Threshold
LNAPL	Light Non-Aqueous Phase Liquid
LPAH	Low Molecular Weight Polycyclic Aromatic Hydrocarbons
MCL	Maximum Contaminant Level
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
MCUL	Minimum Cleanup Level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MLLW	Mean lower low water

MTCA	Model Toxics Control Act
NAPL	Non-Aqueous Phase Liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NRRB	National Remedy Review Board
O&M	Operation and Maintenance
OMMP	Operations, Maintenance, and Monitoring Plan
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PCC	Pollution Control Commission
PCP	Pentachlorophenol
PRP	potentially responsible party
PSDDA	Puget Sound Dredged Disposal Analysis
PSEP	Puget Sound Estuary Program
PSR	Pacific Sound Resources
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RPM	Remedial Project Manager
SMS	Sediment Management Standards
SQS	Sediment Quality Standards
SSC	State Superfund Contract
SWPPP	Storm Water Pollution Prevention Plan
TEF	Toxicity Equivalent Factor
TBC	To Be Considered
TOC	Total Organic Carbon
TSDF	treatment, storage, disposal facility
TPAH	Total polycyclic aromatic hydrocarbon
TSS	Total Suspended Solids
UAO	Unilateral Administrative Order
USACE	U.S. Army Corps of Engineers
UPI	upper prediction interval
VOC	Volatile Organic Compound
WAC	Washington Administrative Code
WSDOH	Washington State Department of Health
WSF	Washington State Ferries
WQS	Water Quality Standards

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EXECUTIVE SUMMARY

The Wyckoff Eagle Harbor Superfund Site is located on the east side of Bainbridge Island, in central Puget Sound, Washington. The site includes the former Wyckoff wood-treating facility, contaminated sediments in adjacent Eagle Harbor, and a former shipyard. The site is divided into three Operable Units (OUs): West Harbor, East Harbor, and the Soil and Groundwater of the former Wyckoff facility.

Remedies for each operable unit include the following:

Soil and Groundwater Operable Unit (originally two separate units; later combined) – Environmental Protection Agency (EPA) conducted time-critical removal actions in 1992 and 1994 removing creosote and pentachlorophenol (PCP) contaminated sludges and oils, disposing asbestos, and recycling materials from retorts, tanks, and other on-site steel. An interim Record of Decision (ROD) was issued in September 1994 for the Groundwater operable unit which focused on the actions necessary to contain contaminated groundwater at the Wyckoff site: replace the existing treatment plant, maintain and upgrade the extraction system, install a physical barrier, and seal on-site drinking water wells that could act as conduits for migration of contaminants to deeper aquifers.

In February 2000, EPA issued a final ROD for the Soil and Groundwater operable units selecting thermal remediation (i.e., steam injection) as the cleanup remedy. This remedy included constructing a sheet-pile wall around the highly contaminated Former Process Area, conducting a pilot study to test the effectiveness of steam injection, consolidating contaminated soil from outside to within the Former Process Area, monitoring the lower-aquifer groundwater, and implementing institutional controls. The ROD stated that if the steam injection pilot study showed the technology could not meet performance goals, then the contingency remedy, site containment, would be implemented. The site containment remedy would consist of a surface soil cap over the Former Process Area, containment of contaminated groundwater and non-aqueous phase liquid (NAPL) with a sheet-pile wall and groundwater extraction system, construction of a replacement treatment plant for ongoing treatment of contaminated groundwater, shoreline protection for the sheet-pile wall, long-term monitoring of hydraulic containment and contaminant distribution and movement, and institutional controls to prevent consumption of upper aquifer groundwater. After initial pilot testing of the thermal remediation remedy showed this technology couldn't meet the Remedial Action Objectives, EPA began implementing the contingent containment remedy.

West Harbor Operable Unit – The West Harbor Operable Unit Record of Decision was signed in

September 1992 and included evaluation and control of upland sources of contamination, excavation and upland disposal of mercury-contaminated sediments, and placement of a clean sediment cap over areas of concern. The 1992 ROD was amended in December 1995 to include construction of a nearshore fill and confined disposal facility in intertidal areas adjacent to the former shipyard property to hold hotspot sediments, and implementation of contaminant source control measures at the former shipyard property to prevent soil contaminants from entering Eagle Harbor through groundwater seeps or surface water runoff.

East Harbor Operable Unit – In 1993 and 1994, EPA placed clean sediments over a 54-acre hotspot area as part of a non-time-critical removal action. In September 1994 EPA issued a ROD for this operable unit which called for monitoring and maintaining the existing sediment cap and capping remaining subtidal areas of concern, monitoring the success of natural recovery in intertidal areas, enhancing existing institutional controls to reduce public exposure to contaminated fish and shellfish, long-term monitoring of the sediment cap, and demolishing in-water structures. A September 2007 Explanation of Significant Differences (ESD) required the construction of an Exposure Barrier System (EBS) to cap contaminated portions of the West Beach and subtidal sediments discovered in 2005.

Current performance of the remedy at each Operable Unit is as follows:

Soil and Groundwater Operable Unit. Overall, the containment remedy is currently functioning as designed. The aging groundwater treatment plant (GWTP) has been replaced. The new plant was completed in 2009 and went online in April 2010. Monitoring has generally demonstrated that the groundwater extraction system is providing hydraulic containment; however, there have been instances during periods of heavy precipitation when containment was not demonstrated. Recent monitoring, in 2011, indicates that containment is currently being demonstrated. The sheet-pile wall is showing signs of corrosion in the splash zone. Institutional controls are in place to prevent the installation of drinking water wells.

West Harbor Operable Unit. The remedy is currently functioning as designed. The asphalt cap, best management practices (BMPs), confined disposal facility (CDF), and tidal barrier performance are being monitored. Performance standards are currently being met and are documented in the quarterly and annual monitoring reports. Institutional controls are in place to control contact with contaminated soils and consumption of marine organisms in Eagle Harbor.

East Harbor Operable Unit. Overall, the remedy is functioning as designed. The subtidal, intertidal, and EBS caps are monitored according to the operations, maintenance and monitoring plan (OMMP) to determine cap stability, effectiveness of contaminant isolation, natural

recovery, and habitat use. In some isolated areas of the subtidal cap, material thickness is less than the target remedial goals. These areas include a small area within the ferry navigation lane. The area of the subtidal cap within grid-cell J-9 also does not meet target thickness goals, however, surface sediment sample results from this area show no exceedances above cleanup levels. The Intertidal Cap remains within target thickness, shows effective contaminant isolation of underlying contaminated sediments and provides habitat for a number of species. The EBS may not have achieved physical stability particularly in the lower intertidal areas with apparent losses in the lower intertidal areas and material gains in the upper intertidal zones. Additional material replacement may be required in the future to maintain physical stability. However, there are no exceedances above cleanup levels in the cover material thus showing that the EBS is effectively isolating underlying contaminated sediment. Functional habitat is observed in the North Shoal and East Beach areas. The North Shoal and East Beach have met the 10 year natural recovery goals except at two surface stations. Both the North Shoal and East Beach show continued presence of subsurface hydrocarbons. Institutional controls are in place to control contact with contaminated sediment and consumption of marine organisms in Eagle Harbor.

Protectiveness of the remedies is as follows:

Soil and Groundwater Operable Unit. The remedy is expected to be protective to human health and the environment when the soil cap is constructed and appropriate institutional controls are in place for the anticipated future land use (currently planned to be a park). Exposure pathways that could result in unacceptable risks are currently being controlled by the fencing, sheet-pile wall and groundwater treatment system and no one is currently using the groundwater as a drinking water source.

West Harbor Operable Unit. The remedial actions are protective. Exposure pathways that could result in unacceptable risks are being controlled by the asphalt cap and intertidal barrier system.

East Harbor Operable Unit. The remedy is currently protective to human health and the environment. The remedial action is expected to be protective of human health and the environment in the long term when the subtidal cap within the ferry navigation lane has been replaced, grid cell J-9 receives capping material, and continued monitoring at East Beach and North Shoal shows natural recovery goals are being met or additional remedial actions are taken, as necessary to meet Remedial Action Objectives.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Wyckoff/Eagle Harbor Superfund Site		
EPA ID: WAD009248295		
Region: 10	**State:** WA	**City/County:** Bainbridge Island, Kitsap
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:**		
Author name (Federal or State Project Manager): Howard Orlean, Tom Clayson, Sharon Gelinas, Deborah Johnston, Marlowe Laubach, Maleena Scarsella		
Author affiliation: USEPA and USACE Seattle District		
Review period: October 2007 – March 2012		
Date of site inspection: 14 February 2012		
Type of review: Statutory		
Review number: 3		
Triggering action date: 26 September 2007		
Due date *(five years after triggering action date)*: 26 September 2012		

Five-Year Review Summary Form (continued)

Issues/Recommendations				
OU(s) without Issues/Recommendations Identified in the Five-Year Review:				
West Harbor				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): **Soils and Groundwater**	**Issue Category: Operations and Maintenance**			
	Issue: Hydraulic containment may not be demonstrated during the wet season or periods of heavy precipitation.			
	Recommendation: Optimize the operation of the extraction system to ensure hydraulic containment is met during all seasons.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	July 2013
OU(s): **Soils and Groundwater**	**Issue Category: Remedy Performance**			
	Issue: No soil cap has been constructed.			
	Recommendation: Construct soil cap of impermeable material per the ROD			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	Sept 2020
OU(s): **Soils and Groundwater**	**Issue Category: Institutional Controls**			
	Issue: Institutional controls have not been established to prevent exposure to contaminated soils in the Former Process Area.			
	Recommendation: Establish institutional controls after the construction of the soil cap to allow for maximum use.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	Dec 2020

OU(s): Soil and Groundwater	Issue Category: Monitoring			
	Issue: The groundwater quality monitoring program is inconsistent			
	Recommendation: Implement a groundwater quality monitoring program with regularly scheduled sampling events to obtain a comprehensive assessment of hydraulic contaminant and long-term concentration trends.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	State	September 2013
OU(s): Soils and Groundwater	**Issue Category: Remedy Performance**			
	Issue: Corrosion of the outer sheet pile wall.			
	Recommendation: Evaluate current wall thickness and provide corrosion protection of the sheet pile wall.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	State	April 2016
OU(s): East Harbor	**Issue Category: Remedy Performance**			
	Issue: Cap material in the subtidal cap within the ferry navigation zone is less than the target remedial goal. This reduces the effectiveness of the cap to isolate underlying contaminated sediments.			
	Recommendation: Repair cap to the target thickness.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	December 2014

OU(s): East Harbor	Issue Category: Remedy Performance			
	Issue: Cap material in the subtidal cap within grid cell J-9 is less than the target remedial goal. This may reduce the effectiveness of the cap to isolate underlying contaminated sediments in the future.			
	Recommendation: Further evaluate whether additional thickness is needed for long-term protectiveness and construct cap to the target thickness as necessary.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	April 2016

OU(s): East Harbor	Issue Category: Remedy Performance			
	Issue: Two surface sediment sampling locations at the East Beach and North Shoal have not met the natural recovery goal. Subsurface sediments still contain substantive residual hydrocarbons.			
	Recommendation: Continue to monitor the East Beach for natural recovery and evaluate the necessity for a remedial action to mitigate subsurface residual contamination.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	April 2016

OU(s): East Harbor	Issue Category: Remedy Performance			
	Issue: Clam tissue sampling at Intertidal Beach, North Shoal and East Beach show elevated levels of contaminants which are still above risk-based levels.			
	Recommendation: Continue monitoring clam tissue to establish time-trends and continue shellfish restrictions.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	April 2016

Protectiveness Statement(s)		
Operable Unit: Soil and Groundwater	*Protectiveness Determination:* Will be Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy is expected to be protective to human health and the environment when the soil cap is constructed and appropriate institutional controls are in place for the anticipated future land use (currently planned to be a park). Exposure pathways that could result in unacceptable risks are currently being controlled by the fencing, sheet-pile wall and groundwater treatment system and no one is currently using the groundwater as a drinking water source.		
Operable Unit: West Harbor	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled by the asphalt cap and intertidal barrier system.		
Operable Unit: East Harbor	*Protectiveness Determination:* Will be Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy is expected to be protective of human health and the environment after replacement and extension of the subtidal cap in the areas of the ferry navigation lane and grid cell J-9, respectively and continued monitoring of East Beach and North Shoal shows that natural recovery goals have been met.		

1. INTRODUCTION

1.1. Purpose of the Review

The purpose of a five-year review is to determine whether the remedy at a site is protective of human health and the environment. This review is required because levels of hazardous substances, pollutants, or contaminants remaining at the site are above levels that would allow for unlimited use and unrestricted exposure. This document describes the five-year review methods, results, and conclusions, and states recommendations for addressing issues found during the review process at the Wyckoff/Eagle Harbor Superfund Site.

1.2. Authority for Conducting the Five Year Review

The U.S. Environmental Protection Agency (EPA) prepared this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

EPA interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii), which states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

1.3. Who Conducted the Five Year Review

EPA Region 10 has conducted this five-year review of the remedial actions implemented at the Wyckoff/Eagle Harbor Superfund site on Bainbridge Island, Washington. The U.S. Army Corps of Engineers (USACE) provided support to EPA in the data analysis and evaluation of remedy protectiveness for this five-year review. The Washington State Department of Ecology (Ecology) has provided support to EPA on remedial activities at the site. USACE, Ecology and EPA also jointly conducted the site inspections.

1.4. Review Status

This is the third five-year review for the Wyckoff/Eagle Harbor Superfund site. The triggering action for this review was the second five-year review completed in September 2007.

2. SITE CHRONOLOGY

Table 1 provides a summary of events, decisions, and actions for the Wyckoff/Eagle Harbor Superfund site. Note: soil and groundwater were originally two separate operable units, but they were later combined.

Table 1. Site Chronology

Event	Date
Pollution Control Commission (PCC) reported direct discharge of oily material from the wood-treating facility to Puget Sound; oil observed on beach adjacent to the facility.	December 1952
EPA began investigating the property due to reports of oil observed on the beach adjacent to the Wyckoff property.	1971
EPA and the Washington Department of Ecology (Ecology) reported oil seepage to Eagle Harbor and required Wyckoff Company to take immediate action to determine the source and reduce or eliminate seepage.	April 1972
U.S. Coast Guard issued Notice of Violation for oil discharge from the facility to Puget Sound.	May 1975
The National Oceanic and Atmospheric Administration (NOAA) advised EPA and Ecology that samples of sediments, fish, and shellfish from Eagle Harbor contained elevated levels of polycyclic aromatic hydrocarbons (PAHs) in both sediments and biota.	March 1984
EPA issued a Unilateral Administrative Order (UAO) requiring the Wyckoff Company to conduct environmental investigation activities under the Resource Conservation and Recovery Act (RCRA) Section 3013 (42 U.S.C. §6924), and Ecology issued an Order requiring immediate action to control stormwater runoff and seepage of contaminants. Data collected at the time revealed the presence of significant soil and groundwater contamination.	August 1984

Event	Date
The Wyckoff/Eagle Harbor Superfund site was proposed for listing on the National Priorities List (NPL).	September 1985
NOAA completed a study relating the presence of PAHs in sediment to the high rate of liver lesions in English Sole from Eagle Harbor.	1985
The Wyckoff Company entered into an Administrative Order on Consent (AOC) with EPA for further investigation of the wood treatment facility.	March 1987
The site was added to the NPL.	July 1987
Under an AOC, the Wyckoff Company agreed to conduct an Expedited Response Action (ERA). The ERA, intended to minimize releases of oil and contaminated groundwater to Eagle Harbor, called for a groundwater extraction and treatment system and other source control measures.	July 1988
Wyckoff Company ceased wood-preserving operations.	December 1988
Completed Remedial Investigation (RI) for Eagle Harbor.	November 1989
Groundwater extraction and treatment system began operating at selected wells.	January 1990
EPA issued a UAO requiring the Wyckoff Company (renamed and currently known as Pacific Sound Resources, Inc.) to continue the ERA with enhancements. The UAO called for increased groundwater extraction and treatment rates, improved system monitoring, and removal of sludge stored or buried at the Wyckoff facility.	June 1991
Completed Feasibility Study (FS) for Eagle Harbor.	November 1991
EPA conducted a time-critical removal action at the Wyckoff facility removing creosote sludges and contaminated oils; disposing asbestos; installing steel sheet-pile; repairing and constructing bulkhead; recycling materials from retorts, tanks, and other on-site steel.	June 1992 - April 1994
ROD was signed for West Harbor OU.	September 1992
EPA placed approximately 209,000 cubic meters of clean sediment materials over a 54-acre area of contaminated sediments in Eagle Harbor (Phase I cap).	September 1993 - March 1994

Event	Date
EPA assumed responsibility for operation and maintenance (O&M) of the groundwater extraction and treatment system.	November 1993
Administrative Order on Consent for Remedial Design for the West Harbor OU issued to PACCAR Inc., Washington State Department of Transportation (DOT), and Bainbridge Marine Services.	November 1993
A time-critical removal action was conducted at the groundwater extraction system and treatment plant to repair/replace failing equipment, upgrade system parts, and perform clean-out of system units.	May - December 1994
Pacific Sound Resources, Inc., and their principals settled their CERCLA liability with EPA and the federal and tribal natural resource trustees in a Consent Decree.	August 1994
Completed Focused RI/FS for the Groundwater OU.	July 1994
EPA issued Interim ROD for the Groundwater OU.	September 1994
EPA issued the ROD for the East Harbor OU.	September 1994
Signed Superfund State Contract (SSC) with Ecology for Groundwater OU Interim Remedial Action.	November 1994
RI field investigations for the Soil and Groundwater OUs	1994 & 1995
EPA sealed and abandoned 12 on-site wells, including two deep drinking water wells, due to concerns that they could provide conduits for migration of contaminants to the deep aquifers.	January - June 1995
Seven original extraction wells were abandoned and replaced by eight new groundwater extraction wells; additional treatment plant upgrades including piping replacement, carbon handling, and installation of dewatering press.	June - December 1995
West Harbor OU ROD Amendment was completed.	December 1995
Non-time-critical removal action in the Soil and Groundwater OU: Site structures were demolished and debris was removed and disposed off-site.	January - June 1996
West Harbor OU potentially responsible parties (PRPs) constructed the remedy at the old shipyard in accordance with the December 1995 ROD Amendment.	March - December 1997

Event	Date
EPA issued a Water Quality Certification for the West Harbor OU remedial work.	April 1997
West Harbor OU PRPs provided the Suquamish Tribe with $110,000 for clam enhancements and other restoration projects performed by the Tribe.	Summer 1997
West Harbor OU PRPs constructed the 2-acre Schel-chelb Estuary restoration at the south shore of Bainbridge Island ("South Bainbridge Estuarine Wetland and Stream Restoration Site"). Planting occurred during February through late Spring 1998.	Summer 1997 - Spring 1998
Completed removal of upland subsurface structures, such as process piping, utility lines, foundations, concrete pads, and asphaltic concrete.	November 1997
EPA issued a "final" Proposed Plan which preferred containment as the cleanup strategy for soil and groundwater.	November 1997
Long-term O&M associated with the containment strategy were of concern to the Department of Ecology; EPA evaluated thermal technologies for possible application at Wyckoff.	1998 – 1999
Region 10 presented thermal technologies evaluation activities and proposed new remedy for removal of contaminants in the soil and groundwater at Wyckoff to the National Remedy Review Board (NRRB).	July 1998
West Harbor OU PRPs established a 0.6-acre eelgrass planting site immediately west of West Harbor OU confined disposal facility (CDF) and cap.	September - October 1998
Completed Focused Feasibility Study Comparative Analysis of Containment and Thermal Technologies	April 1999
West Harbor OU PRPs repaired 3 feet deep by 2 feet wide by 5 feet long depression that developed in surface of CDF during March - April 1999	June 1999
Completed Conceptual Design for thermal remediation of the Soil and Groundwater OUs.	September 1999

Event	Date
EPA issued a second Proposed Plan for the Wyckoff Soil and Groundwater OUs. This Proposed Plan replaced the November 1997 Proposed Plan and presented a change in the cleanup strategy. EPA's preferred remedy in this plan (now the selected cleanup remedy) focused on an innovative technology, called steam injection, to actively remove contaminants from the soil and groundwater. The Proposed Plan presented a contingent containment remedy if it was found through a treatability study that thermal treatment couldn't meet Remedial Action Objectives.	September 1999
Completed removal of the West Dock in the East Harbor OU.	December 1999
EPA issued ROD for Wyckoff Soil and Groundwater OUs.	February 2000
EPA signed Superfund State Contract (SSC) with Ecology for Soil and Groundwater OUs.	May 2000
Completed the following construction activities in the Soil and Groundwater OU: installed over 1,800 lineal feet of sheet-pile containment wall around the Former Process Area; installed 530 lineal feet of sheet-pile wall within a highly contaminated 1-acre area of the site for the steam injection pilot study; created 2 acres of habitat beach to mitigate for habitat loss resulting from construction of the outer sheet-pile wall; extended the existing sediment cap by an additional 15 acres (Phase II cap).	February 2001
Completed the following construction activities in the Soil and Groundwater OU: vapor cap over the steam injection pilot area, all 16 injection wells and seven extraction wells, over 600 thermal monitoring devices, boiler building; on-site water well for boiler feed water; removed additional 10,000 cubic yards of contaminated soil (20,000 CY of contaminated soil were removed during habitat beach construction) to complete cleanup of the Former Log Storage/Peeler Area; Complete capping in East Harbor OU - more materials were placed extending out several hundred feet from the Wyckoff property to form a gently sloping beach which connects the habitat beach to the west with existing intertidal areas to the east.	February 2002

Event	Date
Completed the following construction activities in the Soil and Groundwater OU: modifications to the existing groundwater treatment plant for treatment of new waste streams extracted from the steam injection pilot area; installation of boiler, water softening equipment, heat exchangers, thermal oxidizer, compressor, injection and extraction pumps and associated conveyance pumps and piping, and other pilot system equipment in the boiler building and within the pilot area; and start-up for all new equipment.	September 2002
Completed First Five-Year Review	September 2002
Thermal Remediation Pilot Study conducted	October 2002 – April 2003
Soils and Groundwater OU Contingent Containment Remedy is implemented.	April 2004
Completed Up-Gradient Cutoff Wall soil and groundwater investigation	September 2004
Completed Engineering Evaluation for Thermal and Containment Alternatives	April 2005
Completed South Hillside soil investigation	October 2005
Completed Eagle Harbor Surface Water investigation	December 2005
The Soil and Groundwater OU property was sold to the City of Bainbridge	February 2006
Completed West Harbor OU intertidal barrier	August 2006
Completed Thermal Pilot Study Summary Report	October 2006
Completed West Beach sediment investigation	November 2006
Completed Second Five-Year Review	September 2007
Explanation of Significant Differences (ESD) for the West Beach Exposure Barrier System signed	September 2007
Completed West Beach Exposure Barrier System (EBS)	2008
Replacement groundwater treatment plant (GWTP) construction complete and online	April 2010
Old GWTP demolished	Summer 2011

Event	Date
Operations, Maintenance and Monitoring Plan (OMMP) Addendum for East Harbor completed	May 2011
Year 17 monitoring for East Harbor OU	July – November 2011
East Harbor (East Beach and North Shoal) Focused Feasibility Study began	February 2012
State Superfund Contract signed with Ecology. Ecology takes over operation and maintenance of groundwater treatment plant until April 2014. EPA agrees to conduct Focused Feasibility Study to evaluate additional source removal options for the Soils and Groundwater OUs.	April 2012
Soil and Groundwater OU Focused Feasibility Study began	May 2012

3. BACKGROUND

3.1. Physical Characteristics

The Wyckoff/Eagle Harbor Superfund site is located on the east side of Bainbridge Island in central Puget Sound, Washington (Figure 1). The Wyckoff Site includes the former Wyckoff Company wood-treatment facility, contaminated subtidal and intertidal sediments in Eagle Harbor, and other upland sources of contamination to the harbor, including a former shipyard. On the Wyckoff facility, soil and groundwater are contaminated with creosote (along with its accompanying PAHs), pentachlorophenol (PCP), and other wood-treatment compounds. In Eagle Harbor, marine sediments are contaminated with PAHs and other organics associated with wood treating, and also contaminated with heavy metals such as mercury, copper, lead, and zinc from the shipyard.

3.2. Land and Resource Use

3.2.1. Current Land Use

More than 20,000 people live on Bainbridge Island. Land use on Bainbridge Island is principally residential, with some commercial and industrial use. An urban area, formerly the City of Winslow (population 2,800), lies on the north shore of the Harbor. Residences, commercial centers, a city park, several marinas, a Washington State Ferry repair yard, a bulkhead enterprise, and a ferry terminal characterize the northern shoreline. The western and southern shores are primarily lined with residences, farms, marinas, and a boatyard. On the south shore at the harbor mouth, the former wood-treating facility extends into the harbor on fill. The west beach and the hillside behind the former process area of the wood-treating facility is Bainbridge Island parkland. The City of Bainbridge purchased 50 acres which includes the intertidal portions of the East Harbor OU and the entire Soil and Groundwater OU in 2007 with the intent for the land to be used as a park. The westernmost portion of the former wood-treating facility property is now the Bainbridge Island Japanese American Exclusion Memorial, which was dedicated on 30 March 2011. Eagle Harbor is heavily used by recreational boaters, "live-aboards," and ferries to and from Seattle. Approximately 2,000 people live within one mile of the Wyckoff Site. The nearest residence is located less than 1/4 mile away.

The upper aquifer beneath the Former Process Area is classified as non-potable due to salinity. Groundwater in the upper aquifer south and west of the Former Process Area and in the lower aquifer is not currently used as drinking water but is assumed to be potential sources of drinking water.

A significant use of the harbor is ferry transport of vehicles and passengers between the City of Bainbridge Island and Seattle. Currently, approximately twenty-three runs are made per day. The harbor is also used for moorage of pleasure boats, house boats, and working boats. Fishing,

crabbing, and clam-digging were common recreational activities until 1985, when the Bremerton-Kitsap County Health District issued a health advisory to address bacterial and chemical contamination of seafood in Eagle Harbor. The advisory, recommending against the harvest and consumption of fish and shellfish, has significantly reduced recreational harvest of seafood from the harbor.

Eagle Harbor is within the usual and accustomed fishing area of the Suquamish Tribe, whose reservation is located on the Kitsap Peninsula north of Bainbridge Island. The Suquamish Tribe retains the right to harvest fish and marine invertebrates and to have fishery resource habitat areas protected within the Suquamish Tribe's usual and accustomed fishing area.

The current zoning of the Wyckoff property is Water-Dependent Industrial. Uses under the current zoning may include retail commercial, indoor entertainment, cultural and government facilities, associated parking, agriculture, boatyards, and marine sales and repair.

3.2.2. Reasonably Anticipated Future Land Uses

The anticipated future use of the West Beach in the East Harbor OU and Soil and Groundwater OU hillside is to remain parkland. The Former Process Area within the Soil and Groundwater OU will continue to be excluded from public use until cleanup has been achieved. Plans call for Pritchard Park (currently encompassing the West Beach area and the hillside south of the existing Soil and Groundwater OU) to be extended to include the Former Process Area (also known as the Point) once the remediation of the area is completed. The West Harbor OU will continue to be used as a Washington State Ferry repair yard.

3.3. History of Contamination

From the early 1900s through 1988, a succession of companies treated wood at the Wyckoff property for use as railroad ties and trestles, telephone poles, pilings, docks, and piers. Initially the poles were treated by wrapping with burlap and asphalt, but by 1910 pressure treatment began with creosote/bunker oil. The Wyckoff wood-preserving plant was one of largest in the United States and its products were sold throughout the nation and the rest of the world. Wood-preserving operations included: (1) the use and storage of creosote, pentachlorophenol, solvents, gasoline, antifreeze, fuel and waste oil, and lubricants; (2) management of process wastes; (3) wastewater treatment and discharge; and (4) storage of treated wood and wood products.

The main features of the wood-treating operation included: (1) a process area, which included numerous storage tanks and process vessels such as retorts; (2) a log storage and log peeler area; and (3) a treated log storage area.

There is little historical information about the waste management practices at the Wyckoff facility. Prior to reconstruction of the Wyckoff facility in the 1920s, it is reported that logs were floated in and out of a lagoon that once existed at the site. The lagoon has since been filled. Treated logs

were also transported to and from the facility at the former West Dock via a transfer table pit, and the chemical solution that drained from the retorts after a treating cycle went directly on the ground and seeped into the soil and groundwater below the surface. This practice began around the mid-1940s until operations ceased in 1988. Wastewater was also discharged into Eagle Harbor for many years, and the practice of storing treated pilings and timber in the water continued until the late 1940s. Further site contamination occurred due to drips from treated poles and sloppy handling of used treatment product. The log storage area was primarily used to store untreated wood.

Groundwater and soils at the wood-treating facility are contaminated with chemicals from the wood treatment process, primarily creosote-derived PAHs, PCP, aromatic carrier oils, and dioxins/furans. Since 1993, the on-site extraction system has removed approximately 155,000 gallons of NAPL from the ground and treated over 550 million gallons of contaminated groundwater. It is estimated that 1 million gallons of NAPL still remain in the subsurface.

Sediments in areas of Eagle Harbor were contaminated with PAHs and other organic compounds, as well as with metals, primarily mercury. The wood treating facility was the major source of PAHs to East Harbor through both past operating practices and contaminant transport through the subsurface. An additional source of contaminants to Eagle Harbor was created when sludge from tanks and sumps was used as fill material between an old and new bulkhead at the Wyckoff site in the 1950s. In the West Harbor, PAH contamination in nearshore sediments appeared to be from combustion products, minor spills, and pilings and piers, while subtidal PAH contamination in the West Harbor is believed to reflect a combination of these sources, disposal practices at the former shipyard, and releases from the Wyckoff property. Elevated concentrations of metals, particularly near the former shipyard, are associated with past shipyard operations, including the application, use, and removal (by sandblasting) of bottom paints and antifoulants. Research in Eagle Harbor has identified combustion sources that also add to the PAH load in sediments.

3.4. Initial Response

Due to reports of oil observed on the beach, EPA began investigating the property in 1971. In 1984, EPA issued an order requiring the Wyckoff Company to conduct environmental investigations. Data collected at the time revealed the presence of significant soil and groundwater contamination. Numerous other investigations were conducted at this site prior to initiation of the RI/FS. The Wyckoff Company, EPA, Ecology, and NOAA all investigated other aspects of the site in the early to mid-1980s under regulatory authority other than CERCLA authority. Although work was conducted under Resource Recovery and Conservation Act (RCRA) authority, the site was not considered a treatment, storage, and disposal facility (TSDF).

The site, including Eagle Harbor, the wood-treating facility, and other sources of contamination to Eagle Harbor, was listed on the Superfund NPL in July 1987. In July 1988, the Wyckoff

Company was ordered by EPA to install groundwater extraction wells and a groundwater treatment plant in an effort to halt continuing release of wood-treating contaminants to Eagle Harbor.

A settlement with the Wyckoff Company was embodied in a Consent Decree entered in Federal District Court in August 1994. The Decree created the Pacific Sound Resources (PSR) Environmental Trust into which the heirs of the Wyckoff Company founders, owners, and operators placed all ownership rights and shares in the Company to allow the Trust to maximize liquidation of all company assets, including non-wood-treating holdings, for the benefit of the environment. The beneficiaries of the Trust are the United States Department of Interior, NOAA, and the Suquamish and Muckleshoot Tribes, as Natural Resource Trustees, as well as EPA for reimbursement of CERCLA remedial costs. A memorandum of agreement was entered into by the beneficiaries of the Trust to ensure that settlement proceeds would be applied toward both environmental response and natural resource restoration goals.

The groundwater pump-and-treat systems were put online in 1990. In November 1993, EPA assumed control of the site and operation of the systems and discovered that both the treatment plant and extraction systems were in a state of disrepair. New extraction wells were installed to replace the original seven and a variety of operational and process improvements were made to the treatment system.

Other actions taken to deal with the contamination include demolition and removal of the buildings, structures, above ground and underground storage tanks, underground foundations and piping, and the removal of asbestos, sludge, and some heavily contaminated soil.

3.5. Basis for Taking Action

The Site was divided into four OUs; however, the 2000 ROD states that the Soil and Groundwater OUs will be managed as one unit known as the Soils and Groundwater OU (Figure 1). Following are brief descriptions of each OU:

- Soil OU. Surface and subsurface soil extending to the maximum elevation of the water table (or other fluid boundary).
- Groundwater OU. Subsurface soil and groundwater beneath the maximum elevation of the water table (or other fluid boundary) extending toward Eagle Harbor and including groundwater contaminated by fluids migrating from onshore from the former wood-treating facility.
- West Harbor OU. Intertidal and subtidal surface sediments located within the West Harbor OU boundary.

- East Harbor OU. Intertidal and subtidal surface sediments located within the East Harbor OU boundary.

The following risk-related information applies to the entire Wyckoff/Eagle Harbor site. Human populations potentially exposed to contamination include children and adults who consume contaminated fish and/or shellfish, and individuals, particularly children, who might be exposed to contaminated intertidal sediments through dermal exposure (skin contact) or incidental ingestion. Risks from four exposure routes were calculated, including ingestion of contaminated clams and crabs, ingestion of contaminated fish, ingestion of contaminated intertidal sediments, and dermal contact with contaminated intertidal sediments. Marine organisms potentially exposed to contaminated sediments include sediment-dwelling organisms in three major taxonomic groups: mollusca (e.g., clams), polychaeta (worms), and crustacea (e.g., amphipods).

Human health risks for Eagle Harbor are primarily associated with the consumption of shellfish. The original Eagle Harbor human health risk assessment described in the East and West Harbor RODs used a high (95^{th} percentile) fish and shellfish ingestion rate, computed from the 1988 Puget Sound Estuary Program (PSEP) study of seafood consumption in Puget Sound. The high rate for shellfish consumption was estimated to be 21.5 grams per day, equivalent to a 1/3-pound serving a week. The fish consumption rate was 95.1 grams/day for fish. This rate corresponds to 230 servings of 1/3-pound of fish over the course of a year. (The study estimated that an average consumer eats at most 30 such servings of fish and three such servings of shellfish per year). The high rates were used for the reasonable maximum exposure (RME) assumption for adults. These assumptions were modified to develop ingestion rates for children, based on body weight ratios.

In the West Harbor, cancer risks in the 10^{-3} range were associated with clam tissues from areas near the ferry terminal and the former shipyard. For the East Harbor, cancer risks in the 1E-3 range were associated with clams collected from beaches adjacent to the Wyckoff facility.

3.5.1. Soil Operable Unit

The Soil OU was divided into three components as shown on Figure 2, the Former Log Storage/Peeler Area (now currently part of West Beach), the Former Process Area (also known as "the Point"), and Well CW01 Area (now currently the hillside and part of Pritchard Park.) Widespread near-surface and subsurface soil contamination were noted in these areas, with very elevated levels of contamination in the Former Process Area. The chemicals of concern (COCs) in soil are nine PAHs (benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and naphthalene), PCP, and dioxins/furans. The primary contributor to cancer risk through soil ingestion by future residents (one of the residential exposure scenarios that were evaluated in the baseline human health risk assessment) is benzo(a)pyrene, a carcinogenic PAH. The remaining carcinogenic high-molecular-

weight PAHs (HPAHs), PCP, and dioxins make up the rest of the cancer risk contribution. The primary contributor to non-cancer risk is naphthalene with a calculated hazard quotient of 22.8.

3.5.2. Groundwater Operable Unit

The Groundwater OU includes the soil and groundwater in the saturated zone beneath the Soil OU. The Groundwater OU is composed of two water-bearing zones separated by a layer of low-permeability material, called the aquitard. These water-bearing zones (i.e., the upper and lower aquifers) consist of sand and gravel with variable amounts of silt. The upper aquifer is limited to the area immediately around the Wyckoff site and consists of fill and a marine sand and gravel unit. Groundwater levels (water table) typically range from 5 to 10 feet bgs. It is separated from the lower aquifer, a regional feature, by an aquitard comprised of stiff marine silt and dense to hard glacial material. The top of the aquitard extends from near ground surface in the south-central portion of the site to approximately 75 feet bgs along the northern portion of the site. The aquitard appears continuous throughout the site; its thickness varies from 10 feet to 40 feet, but may be as thin as 4 feet in isolated areas, and in some locations, contains interbedded sand layers. Some evidence of interconnection between the upper and lower aquifer exists, such as pumping one aquifer and affecting levels in the other, tidal influence noted in upper aquifer wells following construction of the perimeter sheet-pile wall, and unexpected cooling during the thermal pilot study. The lower aquifer is continuous across the site and is strongly influenced by tides. The lower boundary of this aquifer has not been characterized; however, it is believed to extend to approximately 200 feet bgs based on regional studies.

In the development of cleanup alternatives, the Groundwater OU was divided into three areas: the upper aquifer beneath the Former Process Area, the upper aquifer beneath the Former Log Storage/Peeler Area, and the lower aquifer.

Light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL) have been identified in the upper aquifer beneath the Former Process Area. Prior to installation of the perimeter sheet-pile containment wall in 2001, seeps of NAPL into the intertidal area were observed along the eastern and northern shoreline. The seeps appeared to coincide with observations of LNAPL in groundwater on-site. DNAPL was also observed on the harbor floor in the Log Rafting Area west of the large dock (the former West Dock).

Data from the RI (June 1997) and subsequent investigations by the USACE indicate that there are approximately 1 million gallons of NAPL in the upper aquifer of the Former Process Area. The low-permeability layer (aquitard) helps to minimize the downward vertical migration of DNAPL to the lower aquifer.

COCs in the upper aquifer groundwater are thirteen PAHs, PCP, and dioxins/furans[1], which are present in the groundwater in the form of mobile NAPL, dissolved constituents, and residual NAPL held in soil pore spaces. Volatile organics and base/neutral and acid extractables (BNAs) are also present in the groundwater; however, for purposes of cleanup, they are assumed to be co-located with the PAHs.

Samples collected from the upper aquifer beneath the Former Process Area were not included in the human health risk assessment due to the aquifer being classified as non-potable. Groundwater in the upper aquifer south and west of the Former Process Area and in the lower aquifer are assumed to be potential sources of drinking water. In the upper aquifer groundwater south and west of the Former Process Area, the excess lifetime cancer risk from ingestion of groundwater by future residents ranges from $5x10^{-6}$ to $4x10^{-4}$, with the higher values found near the Former Process Area. In general, the primary contributors to cancer risk in groundwater are benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and benzo(b)anthracene.

In lower-aquifer groundwater, two of the four wells that were included in the risk assessment had contaminant levels that indicated an excess cancer risk greater than 10^{-5} but less than 10^{-4}. However, subsequent field investigations revealed that one of those two wells (CW12) was not screened in the lower aquifer. As a result, data from this well may be representative of either the upper aquifer or contaminant levels penetrating high permeability zones of the aquitard, but not the lower aquifer.

3.5.3. West Harbor Operable Unit

In intertidal samples from the Eagle Harbor collected for the RI, concentrations measured for a number of metals (copper, lead, zinc, cadmium, and arsenic) were found to exceed maximum concentrations measured at background locations. The greatest number of metals detected and the highest concentrations were detected near the former shipyard on the north shore. Subtidal mercury concentrations exceeded maximum background values by between two and twenty times throughout the harbor and were particularly high near the former shipyard.

PAH concentrations were extremely high in intertidal sediments adjacent to the Wyckoff facility (in the East Harbor OU) and, to a lesser extent, near the ferry terminal (West Harbor OU). Concentrations of PAH in sediment adjacent to the former shipyard in the West Harbor were lower, but were still higher than concentrations measured at intertidal background stations. Subtidal samples showed several high PAH values near the former shipyards in the West Harbor. Estimated average concentrations of HPAH, the high-molecular-weight subgroup of PAH

[1] Polychlorinated dioxins and furans were detected in the NAPL samples, but not in the dissolved-phase groundwater.

compounds, were highest north of the Wyckoff facility and in the central harbor, and were significantly higher than background values. Concentrations of total PAH (TPAH) and low-molecular-weight PAH (LPAH) follow the same general pattern. Some PCP contamination was found but it is not widespread.

3.5.4. East Harbor Operable Unit

Section 7 in the East Harbor ROD (EPA 1994) indicated that chemical concentrations in Eagle Harbor sediments and seafood were elevated with respect to background locations. However, human health risk estimates, calculated for inclusion in the East Harbor OU ROD, for exposure to sediment contaminants through dermal contact and sediment ingestion are within or below EPA's range of acceptable risks (EPA's acceptable risk range is from 1 in 10,000 (1E-4) to 1 in 1,000,000 (1E-6)). For seafood ingestion, calculated cancer risks are generally between 1E-4 and 1E-6 at both Eagle Harbor and background locations. The ROD stated "Two data sets (1988 and 1990) were used in estimating the total excess lifetime cancer risks for consumption of clams and yielded comparable results. The highest risk of 1E-3 was associated with clams collected from adjacent to the Wyckoff Facility (East Harbor areas). Background clam tissues collected near the mouth of Eagle Harbor produced risks from 1E-4 to 5E-4. Human health risks for Eagle Harbor are thus primarily associated with the consumption of contaminated shellfish. For the East harbor, specifically, cancer risks in the 1E-3 range were associated with clam tissues from beaches adjacent to the Wyckoff Facility"

Bioassays for acute toxicity and comparison to Apparent Effects Threshold derived sediment values indicated that sediments from many sampled locations in the East Harbor were toxic to amphipods, oyster larvae, or both. The bioassay responses were most severe in areas of high PAH contamination, such as areas of the East Harbor north of the Wyckoff facility. Additional evidence of biological effects in Eagle Harbor included the prevalence of liver lesions and tumor in English sole, as documented by NOAA. Research citing the effects of PAH and other sediment contaminants on marine organisms add to the evidence suggesting potential damage to Eagle Harbor marine life.

4. REMEDIAL ACTION

4.1. Soil and Groundwater OU

From April 1992 through April 1994 EPA conducted time-critical removal actions where creosote and PCP contaminated sludge were excavated and/or removed from the site. Total removals consisted of 10,148 tons of buried sludge; 7,296 tons of sludge stored in the retorts and ruperts; and 11,211 tons of sludge stored in tanks, on-site sumps, and trenches. In addition, 99,987 gallons of creosote and PCP contaminated oil; 426 cubic yards of asbestos; and 2,240 pounds of scrap steel from retorts, ruperts, and tanks were removed from the site.

In September 1994, EPA issued an interim ROD for groundwater, which included the following elements, all of which have been completed:

- Replacement of the existing treatment plant. The design of a new treatment plant began in late 1996 and was completed in July 1998, but construction of the plant was not completed until 2010, following the selection of additional remedial actions for the Groundwater OU in the 2000 ROD.
- Evaluation, maintenance, and upgrade of the existing extraction system/hydraulic barrier operations. These activities were completed prior to 2002.
- Evaluation of the performance of the existing extraction system and installation of a physical barrier, if needed. Because of continued releases to Eagle Harbor and Puget Sound despite ongoing pumping, a slurry wall or sheet pile wall was proposed as the most appropriate kind of barrier.
- Sealing and abandonment of on-site water supply wells in accordance with Washington State regulations.

In February 2000, EPA issued a ROD for the Soil and Groundwater OUs. Remedial action objectives (RAOs) for cleanup of soil addressed potential impacts to residents who could be exposed to contaminants via ingestion, inhalation, or dermal contact. Because residential cleanup standards are the most protective of human health for unknown future land use, they were chosen as a goal for the soil at the Soil OU (Table 2). RAOs for the Soil OU were:

- Prevent human exposure through direct contact (ingestion, inhalation, or dermal contact) with contaminated soil.
- Prevent storm water runoff containing contaminated soil from reaching Eagle Harbor.

Table 2. Soil Cleanup Levels

Contaminant of Concern	Soil Cleanup Level (µg/kg)
Naphthalene	3.20E+06
Acenaphthylene	NA
Acenaphthene	4.80E+06
Fluorene	3.20E+06
Phenanthrene	NA
Anthracene	2.40E+07
Fluoranthene	3.20E+06
Pyrene	2.40E+06
Benzo(a)anthracene	1.37E+02
Chrysene	1.37E+02
Benzo(b)fluoranthene	1.37E+02
Benzo(k)fluoranthene	1.37E+02
Benzo(a)pyrene	1.37E+02
Dibenzo(a,h)anthracene	1.37E+02
Benzo(g,h,i)perylene	NA
Indeno(1,2,3-c,d)pyrene	1.37E+02
Dioxin (2,3,7,8-TCDD)/TEF)	6.67E-03
Pentachlorophenol	8.33E+03

The 2000 ROD also addressed RAOs for cleanup of NAPL in the groundwater at Wyckoff. These RAOs addressed impacts to marine water quality, surface water quality, and sediments in Eagle Harbor. For each contaminant, the numerical standard applied is the most stringent of the State and Federal Marine water quality standards/criteria, risk-based surface water standards for human consumption of organisms (Model Toxics Control Act [MTCA]), and calculated pore-water maximums (Table 3). RAOs for the Groundwater OU were:

- Reduce the NAPL source and quantity of NAPL leaving the upper aquifer beneath the Former Process Area sufficiently to protect marine water quality, surface water, and sediments (e.g., ensure the quantity of NAPL leaving the site will not adversely affect aquatic life and sediments). Site-specific groundwater contaminant concentration limits will be met at the mudline.
- Ensure contaminant concentrations in the upper-aquifer groundwater leaving the Former Process Area will not adversely affect marine water quality, and aquatic life in surface water and sediment.
- Protect humans from exposure to groundwater containing contaminant concentrations above maximum contaminant levels (MCLs).
- Protect the groundwater outside the Former Process Area and in the lower aquifer, which are potential drinking water sources.

Table 3. Groundwater Cleanup Levels [a]

Contaminant of Concern	WA SW Quality Standards (173-201A WAC)	MTCA Method B SW for Human Consump. of Organisms (173-340 WAC)[b]	Federal WQ Stds/ NTR (40 CFR 131)		Federal WQ Criteria		Calculated Pore-Water Conc. Based on SMS or HH	Ground-water Cleanup Level [c]
			Marine Chronic	Human Consump. of Orgs.	Marine Chronic	Human Consump.		
Naphthalene		9880					83	83
Acenaphthylene								
Acenaphthene		643				2,700	3	3
Fluorene		3,460		14,000			3	3
Phenanthrene								
Anthracene		25,900		110,000		110,000	9	9
Fluoranthene		90		370		370	3	3
Pyrene		2,590		11,000		11,000	15	15
Benzo(a)anthracene		0.0296		0.031		0.049	0.308	0.0296
Chrysene		0.0296		0.031		0.049	0.262	0.0296
Benzo(b)fluoranthene		0.0296		0.031		0.049	0.079	0.0296
Benzo(k)fluoanthene		0.0296		0.031		0.049	0.079	0.0296
Benzo(a)pyrene		0.0296		0.031		0.049	0.102	0.0296
Dibrnz(a,h)anthracene		0.0296		0.031		0.049	0.007	0.007
Benzo(g,h,i)perlyene								
Indeno(1,2,3-cd)pyrene		0.0296		0.031		0.049		0.0296
HPAH							0.254	0.254
Pentachlorophenol	7.9 [d]	4.9	143	8.2	7.9	8.2	880	4.9

a. -Measured at the point of compliance. All values are in µg/L. From the February 2000 Soils and Groundwater OU ROD

b. - Values obtained from Washington Model Toxics Control Act (MTCA) Cleanup Levels and Risk Calculations (CLARC II) Update (February 1996);

c. – This column represents the most stringent criteria;

d. – Chronic criteria

4.1.1. Remedy Selection

Thermal remediation, using steam injection and treatment of the extracted groundwater and vapors, was selected as the remedy for the Soils and Groundwater OU in the 2000 ROD. Site features are shown in Figure 3. The remedy components included the following:

- Construct a sheet-pile wall to isolate the pilot study area from the rest of the site, and another sheet-pile wall around the entire Former Process Area.
- Implement thermal remediation of contaminated soil and groundwater in two phases with an on-site pilot test as the first phase.
- Use the existing treatment plant to treat contaminated groundwater from the pilot study system.
- Dispose recovered NAPL off-site.
- Implement contingency remedy (containment with a sheet-pile wall around the perimeter of the site) if the pilot test does not achieve performance expectations.

Additional elements which are common to both the thermal treatment and contingency remedies include:

- Monitor both the upper aquifer outside the Former Process Area and the lower aquifer beneath the Soil and Groundwater OU to identify any trends in groundwater data and determine contaminant trends.
- Establish institutional controls to:
    - ensure that the upper aquifer groundwater outside the Former Process Area and the lower aquifer remain unused for drinking water until protective levels are reached;
    - ensure that the upper aquifer groundwater within the Former Process Area remains unused due to contaminants that may remain after thermal treatment or will remain as part of the contingency remedy; this portion of the upper aquifer is also not potable due to high salinity levels;
    - restrict site use to reduce the risk of direct exposure to surface soil, as necessary.

The containment option (contingency remedy) was implemented in April 2004 based on the inability of thermal extraction to meet remedial action objectives. The pilot thermal treatment system installed in 2002 was decommissioned in 2003. A major component of the terminated thermal remedy for the Soils and Groundwater OU that remains in place to support the ongoing containment remedy is the sheet-pile wall around the highly contaminated area of the Former Process Area to minimize potential flow of contaminants to Eagle Harbor.

A steam injection pilot study was implemented to determine what degree of success, if any, was possible and whether full-scale thermal remediation could meet RAOs. Since the pilot study was unsuccessful at demonstrating the ability of thermal remediation to achieve RAOs, the

contingency remedy was implemented. The contingency remedy consists of a surface soil cap over the Former Process Area, containment of contaminated groundwater and NAPL with the sheet-pile wall and groundwater extraction system, and construction of a replacement treatment plant for ongoing treatment of contaminated groundwater.

4.1.2. Remedy Implementation

Steam Injection Pilot Study

The steam injection pilot study began in the fall of 2002. Operations were hampered by equipment problems, and the pilot study was terminated in the spring of 2003. The total time of operation of the vapor-extraction system was about 1 month, operating continuously no more than 3 days at a time.

Repeated technical issues with the pilot study included issues with the liquid and vapor extraction and conveyance systems and the treatment plant. The most serious problems comprised aspiration of liquid by the vapor-vacuum pumps, overloading of the biological water-treatment system, deterioration of gaskets due to materials incompatible with site contaminants, and clogging of pipes and treatment facilities by precipitating naphthalene.

In addition, equipment constraints limited operations of the system. Constraints included capacity of the treatment plant, inability to treat the vapor stream due to equipment failure, installation of only two liquid-ring vacuum pumps instead of three, installation of a plate-and-frame heat exchanger for the vapor line instead of a shell-and-tube heat exchanger, and insufficient capacity in the vapor condensate receivers.

Prior to the pilot, the average amount of NAPL extracted per month in the pilot study area was approximately 320 gallons with an average of approximately 24 gallons per month in the dissolved phase. During the thermal treatment pilot study, the equivalent of approximately 2,940 gallons of NAPL was recovered from the 1-acre study area:

- 340 gallons as NAPL and
- 9,800 kg (equivalent to 2,600 gallons) in the dissolved phase.

Thus, while the amount of NAPL removed did not show a marked increase during the pilot study, the amount of contaminants removed in the dissolved phase increased dramatically.

During the same time period, the equivalent of 1,455 gallons of NAPL was extracted by the pump-and-treat system from the remaining 7 acres of the Former Process Area:

- 1,295 gallons as NAPL and
- 606 kg (equivalent to 160 gallons) in the dissolved phase.

Despite the fact that a large amount of dissolved contamination was removed during the pilot study, it was determined that RAOs for the entire OU could not be met using this technology.

Contingency Containment Remedy

The contingency containment remedy was implemented in 2004 after the thermal treatment pilot study failed to meet RAOs. The containment remedy currently consists of the following components:

- **Groundwater Extraction and Treatment System** – The groundwater extraction system consists of seven recovery wells screened in the upper aquifer. Pumps installed in these wells draw groundwater and NAPL away from the site perimeter and in toward the extraction wells. Pumping in the upper aquifer also maintains an upward vertical gradient between the lower and upper aquifers. The inward flow direction in the upper aquifer combined with the upward flow direction from the lower aquifer are the primary means of hydraulic containment in the Former Process Area. The groundwater and NAPL recovered from the extraction wells are treated at the onsite groundwater treatment plant (GWTP). A new GWTP was constructed to support the containment remedy. This new GWTP utilizes carbon as the main method of contaminant reduction compared to biological treatment of the old GWTP.
- **Sheet-pile Wall** – A sheet-pile wall was constructed around the Former Process Area to prevent potential flow of contaminants to Eagle Harbor.
- **Long-Term Monitoring** – A monitoring program provides data on water levels in both the upper and lower aquifers beneath the Former Process Area (for confirming hydraulic containment), and on contaminant distribution and movement in the subsurface beneath the Wyckoff Site. Monitoring is on-going.
- **Institutional Controls** – Institutional controls in the form of a Prospective Purchasers Agreement with the City of Bainbridge Island and EPA have been implemented to prevent access to groundwater. Engineering controls including fencing and access controls have been implemented to restrict site use to prevent direct exposure to surface soils.

The following component of the containment remedy has yet to be implemented:

- **Site Cap** – A low permeability site cap is to be constructed over the Former Process Area inside the sheet-pile wall. The purpose of the cap is to limit infiltration of precipitation and reduce the hydraulic loading to the groundwater treatment plant. Precipitation would

be diverted laterally into Puget Sound through a sand drainage layer instead of infiltrating vertically into the site. The cap would also prevent contact with contaminated soil and provides a clean surface, facilitating access by the public. The site cap has not been constructed.

Based, in part, upon an evaluation of thermal technologies conducted by Ecology as part of their Generational Remedy Evaluation (GRE), EPA is reevaluating whether additional source removal actions, including thermal remediation may be applicable for the Soil and Groundwater OUs. As of the writing of this five-year review, EPA is conducting a Focused Feasibility Study (FFS) to evaluate potential source removal options to remove NAPL to the maximum extent practicable.

4.1.3. System Operations/Operation and Maintenance (O&M)

Containment – Sheet-pile Wall

Currently no operation and maintenance activities have been implemented for the sheet-pile wall. No investigation of the sheet-pile wall integrity has been conducted since 2004.

Containment – Groundwater Treatment Plant and Extraction System

The GWTP was replaced during this five-year review period. The demolition and removal of the old treatment plant was completed in 2011. The location of the new treatment plant is shown on Figure 4. The new treatment plant came on line in April 2010. It does not have an activated sludge treatment system such as the old treatment plant had. The only biological component is an aerobic digester for the final solids processing. The new plant uses a 51,000 gallon equalization tank sized for a 3 day holding time at an average influent rate of 11 gpm, which is the expected peak flow rate after the cap and up-gradient hydraulic isolation are completed. The influent is taken from the 7 extraction wells and 2 former pilot extraction wells. The new plant uses dissolved air floatation (DAF) separation for removal of free product and suspended solids, which is aided by a polymer injection system. The effluent from the DAF unit is filtered through a hydromation deep bed filter which uses walnut shell media for grit removal and then polished through a series of three of the five granular activated carbon (GAC) units to remove the PCP and PAH until their concentrations are below the discharge levels specified in Table 4 below. These discharge levels meet the substantive requirements under the National Pollutant Discharge Elimination System (NPDES) permit. Five GAC units are available so the final treatment train can be alternated to allow for change-out of loaded lead units (the first of three units that are in operation at any time) without requiring interruption of treatment operations. Each of the GAC units contains 10,000 pounds of activated carbon. Figure 5 provides the process flow diagram of the new treatment plant.

Table 4. Groundwater Treatment Plant Effluent Discharge Limits

Parameter	Discharge Limit (µg/L)
Naphthalene	4
Acenaphthylene	4
Acenaphthene	4
9H-Fluorene	2
Phenanthrene	2
Anthracene	2
Fluoranthene	2
Pyrene	2
Benzo(a)anthracene	2
Chrysene	2
Benzo(b)fluoranthene	2
Benzo(k)fluoranthene	2
Benzo(a)pyrene	2
Indeno(1,2,3-cd)pyrene	2
Dibenzo[a,h]anthracene	2
Benzo(g,h,I)perylene	2
Total PAHs	20
Pentachlorophenol	6
pH units	6.0-9.0

Primary operations and maintenance of the extraction system and treatment plant include the following:

- Extract groundwater to maintain hydraulic control by adjusting rates to compensate for seasonal water levels
- Maintain extraction pumps
- Remove NAPL from each extraction well as needed
- Maintain treatment plant equipment
- Monitor treatment plant operation efficiency
- Monitor effluent concentrations

In addition, biological compliance monitoring to demonstrate compliance with Washington State Whole Effluent Toxicity Testing and Limits (WAC 173-205) is conducted by the measurement of acute and chronic toxicity affects of effluent on selected aquatic organisms.

Annual operations and maintenance costs for the replacement extraction system and treatment plant are approximately $500,000 to $700,000.

4.2. West Harbor

4.2.1. Remedy Selection

The West Harbor ROD was signed in September 1992 with an amendment in December 1995. The primary RAO for the West Harbor sediments is achievement of the Washington State Sediment Management Standards Minimum Cleanup Levels (WAC 173-204-520) and reduction of contaminants in fish and shellfish to levels protective of human health and the environment.

In order to define areas requiring specific types of remedial action at the time of the ROD, the RAO above was supplemented by three objectives:

- to address sediments containing 5 mg/kg (dry weight) or more of mercury, as a means of source control;
- to address intertidal sediments containing 1,200 µg/kg (dry weight) or more of HPAH. Shellfish in such areas contained carcinogenic HPAH above levels established by EPA as acceptable for protection of human health;
- to address predicted biological impacts, minimize potential sediment resuspension, and limit biological uptake in areas where sediment concentrations of mercury exceed 2.1 mg/kg mercury dry weight.

The major components of the selected remedy for the West Harbor OU include:

- Further evaluation and control of potential upland sources of contamination to West Harbor sediments;
- Excavation, solidification/stabilization (if necessary), and upland disposal of sediments with mercury concentrations exceeding 5 mg/kg (dry weight);
- Placement of a cap of clean sediment over areas of high concern for adverse biological effects and potential contaminant resuspension and bioaccumulation;
- Thin-layer placement of clean sediments to enhance sediment recovery in areas of moderate concern;
- Natural recovery and monitoring in areas predicted to achieve the long-term sediment cleanup objective without sediment remedial action;
- Continued institutional controls to protect human health from exposure to contaminated fish and shellfish; and
- Long-term environmental monitoring to evaluate the effectiveness of the remedy.

In December 1995, EPA issued an amendment incorporating the following changes to the September 1992 ROD:

- Construct a nearshore fill and confined disposal facility (CDF) in intertidal areas adjacent to the former shipyard property. Hotspot sediments were to be placed inside the CDF and capped with clean material and asphalt. This fill would create 0.9 acres of additional land so that the Washington State Department of Transportation (WSDOT) could reserve one acre of the property for private boatyard or other water-dependent operations. To compensate for habitat lost as a result of the nearshore CDF, WSDOT would:
    - Enhance the outer wall of the nearshore CDF with a layer of gravel and/or small pebble to provide favorable habitat (about 0.19 acre) for barnacles and mussels. The habitat would resemble habitat lost at the fill site.
    - Restore 0.6 acre of eelgrass immediately west of the nearshore fill. Eelgrass provides high quality habitat for juvenile fish and other marine life.
    - Construct a 2-acre estuarine salt marsh habitat at the South Bainbridge Estuarine Wetland and Stream Restoration Site (ultimately named Schel-chelb Estuary), near Lynwood Center.
    - Furnish the Suquamish Tribe with materials for a 1.5-acre Manila clam enhancement project.
    - Transfer 6 to 8 acres of tideland from WSDOT to the Suquamish Tribe.
- Implement contaminant source control measures at the former shipyard property acquired by WSDOT to prevent soil contaminants from entering Eagle Harbor through groundwater seeps or surface water runoff. These measures include: the treatment of heavily contaminated soils in two areas; capping of property soils with asphalt; diversion of surface water and groundwater; construction of a shoreline barrier to minimize seawater movement through contaminated soils; implementation of pollution prevention practices; and access restrictions. These measures would meet State of Washington soil cleanup standards for industrial land use.

4.2.2. Remedy Implementation

The initial West Harbor OU remedial construction was completed during the summer of 1997. The tidal barrier system, which includes the Seep Remediation Cap, was completed in 2006 (Figure 6). The total remedy consisted of the following activities.

- Source control through soil stabilization of two upland "hot spot" areas;
- Installation of a tidal barrier system adjacent to the former landfill located in the northwest corner of the upland area to minimize the potential for seeps that could impact capped sediments;

- Installation of a drainage system along the northern boundary of the site to intercept and cut off surface and shallow subsurface water run-on;
- Installation of an asphalt concrete cap across the upland area to minimize the potential for soils to run off to capped sediments.
- Confined disposal facility (CDF) construction for contaminated sediments removed from the site. On Figure 6 the extent is shown as the CDF membrane.
- Sediment capping.
- Mitigation for 0.9 acres of lost aquatic habitat.
- Intertidal barrier system.
- Institutional controls including deed restrictions and site-access controls for the active WSDOT ferry maintenance yard..

4.2.3. System Operations/Operation and Maintenance

WSDOT conducted long-term monitoring of the subtidal and intertidal areas of the West Harbor according to the Operation, Maintenance, and Monitoring Plan (OMMP 1997) for Years 1 through 10 (1998-2007). The OMMP was updated in 2008 for use during Years 11- 20 (2008-2017). The most recent monitoring results (West Harbor OU OMMP Year 14; 2011) are used to determine remedy success. The primary activities associated with the OMMP include the following:

- Upland containment and Best Management Practice (BMP) inspections,
- Intertidal seep monitoring (all locations, with the 2011 locations emphasized, are shown on Figure 7),
- Stormwater treatment system inspection.

All site access controls such as health advisories, deed restrictions, and fencing are operating as constructed.

Annual operation and maintenance costs between 2008 and 2011 were approximately $25,000. Operation and maintenance costs for 2007, prior to the OMMP update in 2008, were approximately $128,000. Other costs within the last five years include the OMMP update for approximately $14,000 and other work by maintenance facility staff associated with the NPDES permit for approximately $25,000.

4.3. East Harbor OU

4.3.1. Remedy Selection

The East Harbor ROD was signed in September 1994. The primary RAOs for the East Harbor sediments are:

- Achievement of the Washington State Sediment Management Standards (SMS) Minimum Cleanup Levels (MCUL) (WAC 173-204-520)
- Reduction of contaminants in fish and shellfish to levels protective of human health and the environment (Tables 5 and 6).

For subtitle areas the following actions were required in order to achieve RAOse:

- Capping of sediment if the top 10 centimeters of sediment contain contaminant concentrations above the MCUL at the completion of upland source control.

For intertidal areas monitoring was required to determine if the surface 10 centimeters achieve the MCUL within 10 years from control of significant sources to these areas through natural attenuation processes. This is supplemented by an intertidal objective of concentrations of 1,200 µg/kg (dry weight) HPAHs, developed by EPA to address human health risks from consumption of contaminated shellfish in intertidal areas.

An Explanation of Significant Differences (ESD) was signed in September 2007, specific to the West Beach portion of the East Harbor OU. The ESD is consistent with the ROD RAOs and prescribed the construction of an exposure barrier system (EBS) to address additional contamination discovered following construction of the West Beach mitigation cap. In addition to sediment quality standards (SQS) of the SMS, the ESD updated the cleanup levels to include the Washington MTCA Method B soil cleanup levels (WAC 173-340-740). The EBS is intended to provide a protective and durable exposure barrier allowing typical recreation activities on the beach and in the harbor with a low likelihood of contact with underlying contaminated sediments.

Table 5. Sediment Standards Chemical Criteria

Chemical of Concern	SQS (mg/kg organic carbon)	MCUL (mg/kg organic carbon)	MTCA Method B Soil CUL (mg/kg)
Mercury	0.41mg/kg (dry weight)	0.59 mg/kg(dry weight)	NA
LPAHs	370	780	--
Naphthalene	99	170	3,200
Acenaphthylene	66	66	--
Acenaphthene	16	57	4,800
Fluorene	23	79	3,200
Phenanthrene	100	480	--
Anthracene	220	1,200	24,000

Chemical of Concern	SQS (mg/kg organic carbon)	MCUL (mg/kg organic carbon)	MTCA Method B Soil CUL (mg/kg)
2-Methylnaphthalene	38	64	320
HPAHs6	960	5,300	--
Fluoranthene	160	1,200	200
Pyrene	1,000	1,400	2400
Benzo(a)anthracene	110	270	0.14
Chrysene	110	460	0.14
Benzo(b)fluoranthene	--	--	0.14
Benzo(k)fluoranthene	--	--	0.14
Total Benzofluoranthenes	230	450	--
Benzo(a)pyrene	99	210	0.14
Indeno(1,2,3-c,d)pyrene	34	88	0.14
Dibenzo(a,h)anthracene	12	33	0.14
Benzo(g,h,i)perylene	31	78	--
Pentachlorophenol	--	--	8.3

SQS – Sediment Quality Standard
MCUL – Minimum Cleanup Level

Table 6. Sediment Cleanup Levels - Biological Criteria

SQS Biological Criteria	MCUL Biological Criteria
Sediments are determined to have adverse effects on biological resources when any of the confirmatory marine sediment biological tests of WAC 173-204-315(1) demonstrate the following results (a) Amphipod: the test sediment has a higher mean mortality than the reference sediment and the test sediment mean mortality exceeds 25%, on an absolute basis. b) Larval: the test sediment has a mean survivorship of normal larvae that is less than the mean normal survivorship in the reference sediment and the test sediment mean normal survivorship is less than 85% of the mean normal survivorship in the reference sediment (i.e., the test sediment has a mean combined abnormality and mortality that is greater than 15% relative to time-final in the reference sediment). c) Benthic abundance: The test sediment has less than 50% of the reference sediment mean abundance of any one of the following major taxa: Crustacea, Mollusca, or Polychaeta, and the test sediment abundance is statistically different from the reference sediment abundance. d) Juvenile polychaete: The test sediment has a mean biomass of less than 70% of the reference sediment mean biomass and the test sediment biomass is statistically different from the reference sediment biomass. e) Microtox: The mean light output of the highest concentrations of the test sediment is less than 80% of the reference sediment, and the two means are statistically different.	The MCUL is exceeded when any two of the biological tests exceed the SQS biological criteria; or one of the following test determinations is made: (i) Amphipod: the test sediment has a higher mean mortality than the reference sediment and the test sediment mean mortality is more than 30% higher than the reference sediment mean mortality, on an absolute basis. (ii) Larval: the test sediment has a mean survivorship of normal larvae that is less than the mean normal survivorship in the reference sediment and the test sediment mean normal survivorship is less than 70% of the mean normal survivorship in the reference sediment (i.e., the test sediment has a mean combined abnormality and mortality that is greater than 30% relative to time final in the reference sediment). (iii) Benthic abundance: The test sediment has less than 50% of the reference sediment mean abundance of any two of the following major taxa: Crustacea, Mollusca, or Polychaeta, and the test sediment abundances are different from the reference abundances. (iv) Juvenile polychaete: The test sediment has a mean biomass of less than 50% of the reference sediment mean biomass and the test sediment biomass is statistically different from the reference sediment biomass.

SQS – Sediment quality standard
MCUL – Minimum cleanup level

4.3.2. Remedy Implementation

The East Harbor Subtidal and Intertidal Sediment Caps were completed in three phases over nine years (1993-2002). The West Beach mitigation cap was constructed in 2002, while the EBS was completed in 2008. Completion of the cap, intertidal activities, and EBS described below provide

the basis for the remedy implementation of the East Harbor OU. The major components of each phase are shown in Figure 8 and include:

Phase I

EPA issued an Action Memorandum for a non-time-critical removal action on June 15, 1993. Sediment placement activities began September 1993, and concluded in March 1994. Approximately 275,000 cubic yards (cy) of Snohomish River dredged material was placed in the East Harbor, covering over 54 subtidal acres, to complete the removal action.

Phase II

In 2000-2001, EPA extended the original subtidal sediment cap by an additional 15 acres in a nearshore subtidal area adjacent to the former Wyckoff facility, known as the log-rafting area. This area was not remediated during Phase I due to a lack of upland source control at the time. The cap extended from the 1994 cap's approximate 3-foot thickness contour (located approximately 900 ft offshore) to the Wyckoff facility's northern shoreline.

Phase III

In early 2002, EPA placed an additional 50,000 cubic yards of clean upland borrow material in a shallow subtidal and intertidal areas to create intertidal habitat to form a continuous intertidal beach along the Eagle Harbor shoreline.

West Beach/Exposure Barrier System

To offset habitat loss associated with the sheet-pile wall construction and to enhance existing shoreline functions of Eagle Harbor and the adjacent Puget Sound shoreline, EPA created a total of 1,154 feet (approximately 2 acres) of intertidal beach along the western portions of the property (in the north portion of the Former Log Storage/Peeler Area). Construction was completed in February 2002. This habitat mitigation beach has been renamed the West Beach and is considered part of the East Harbor Operable Unit based on its elevation and intertidal and subtidal nature.

In the summer of 2005, Bainbridge Island residents reported observations of creosote odors and orange staining on the West Beach, which was being accessed by the public for recreational use. EPA responded to these reports by investigating the nature and extent of the contamination in beach sediment and water. EPA confirmed the contamination and initiated the design of an Exposure Barrier System (EBS) to eliminate potential human health hazards. Construction of the EBS began in fall 2007 and was completed in 2008. The EBS covers high intertidal and shallow subtidal sediments and consists of the following:

- **Geotextile.** A porous geotextile placed on the original beach minimizes the potential for contaminated sediments to move into the environment. The geotextile also provides an

additional deterrent for digging and a visual barrier to anyone who may dig deep into the beach.

- **Cobble Layer.** A 1-foot-thick layer of 3- to 5-inch cobbles placed on top of the geotextile provides an armor layer to resist wave energy, a highly permeable drainage layer to convey groundwater to the bottom of the beach, a deterrent to digging a deep hole in the beach, and a visual marker that shows if the habitat layer above has eroded to the point of exposing the armor, indicating that beach maintenance is needed to replace or to redistribute the habitat fill above. Cobble was placed over and beyond the geotextile from approximately +14'MLLW to -5'MLLW.
- **Habitat Fill Layer.** Finally, a 2-foot-thick layer of habitat fill was placed to completely cover the cobble layer providing fish habitat and completing the total 3-foot-thick separation provided by the entire EBS beach-cover system. The toe of the EBS was tied into the existing subtidal cap via an extension of a 3 foot thick habitat layer of sand and gravel to a depth of -10'MLLW, extending the toe to the southern edge of the existing harbor cap.

4.3.3. System Operations/Operation and Maintenance

EPA is conducting long-term monitoring of the subtidal and intertidal areas of the East Harbor according to the Operations, Maintenance, and Monitoring Plan (OMMP) that was approved by EPA in July 1994, amended in May 1999, October 2002, and in May 2011. The most recent monitoring results (East Harbor OU OMMP Year 17; 2011) are used to determine remedy success. The primary activities associated with the OMMP include the following:

- Subtidal sediment cap monitoring to determine physical stability, effectiveness of containing underlying contaminated sediments, and potential for recontamination.
- Intertidal area monitoring to determine physical stability in areas where cap material was placed, effectiveness of containing underlying contaminated sediments, natural recovery, and habitat use.
- EBS monitoring to determine physical stability, effectiveness of containing underlying contaminated sediments, and habitat function.

Results from the latest monitoring are presented in the Data Review section below.

Total costs from the last five years associated with the construction of the EBS cap in 2008 and operation and maintenance of the East Harbor OU are approximately $2,700,000.

5. PROGRESS SINCE LAST REVIEW

5.1. Protectiveness Statements from 2007 Review

The following protectiveness statement was presented for the overall Wyckoff/Eagle Harbor Superfund Site in the 2007 Five-Year Review Report:

> "All immediate threats at the site have been addressed through containment of contaminated soil and groundwater with a pump-and-treat system and sheet-pile wall, removal and consolidation of contaminated soil, removal and capping of sediments, and the installation of fencing and warning/fish advisory signs. The long-term protectiveness of the remedial actions will be verified by additional monitoring and data collection as outlined in Table 16 [of the 2007 FYR]."

5.1.1. Soil and Groundwater OU

The protectiveness statement for the Soils and Groundwater OU in the 2007 five-year review (FYR) was:

> "The final soil and groundwater remedy for the Former Process Area is expected to be documented in 2008. The remedy is expected to be protective of human health and the environment and to comply with Applicable or Relevant and Appropriate Requirements (ARARs) upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through operation of the groundwater extraction and treatment system and institutional controls to prevent exposure to contaminated soil and groundwater."

5.1.2. West Harbor OU

The protectiveness statement for the West Harbor OU in the 2007 FYR was:

> "The remedies have been implemented and are achieving the ROD objectives and ARARs. Institutional controls are effective in controlling access to the upland areas, and fish advisories are in place."

5.1.3. East Harbor OU

The protectiveness statement for the East Harbor OU in the 2007 FYR was:

> "Phases 1-3 of the subtidal and intertidal cap have been implemented and are protective of human health and the environment. The remedy for residual contamination in the West Beach intertidal area is expected to be protective of human health and the environment upon completion and, in the interim, institutional controls are in place to limit exposure. Areas of residual contamination in the North Shoal and East Beach areas are posted to

restrict public access. Fish advisories are in place to prevent the ingestion of contaminated fish and shellfish."

5.2. Recommendations and Status from the 2007 Five Year Review

5.2.1. Overall Site (all OUs)

Recommendation: Evaluate any potential public health issues related to real or possible human exposure to toxic materials at the site.

Status: The Agency for Toxic Substances and Disease Registry (ATSDR) conducted a health consultation resulting in a report dated July 2009. The consultation purpose was to identify potential harmful human health effects resulting from exposures to contamination remaining on site. The focus of the consultation addressed specific activities that the public may participate in including using the beach, swimming in the water, eating fish or shellfish, harvesting and eating berries, and using the hillside trail system. A summary of the ASTDR health consultation is provided in the Technical Assessment section (Section 7.3.1.4) of this FYR. In addition, the Washington State Department of Health (WSDOH) performed a health consultation for the commercial harvest of geoducks using data from two commercial harvest tracts near the Site. A summary of the WSDOH health consultation is also provided in the Technical Assessment section of this FYR.

5.2.2. Soils and Groundwater OU

Recommendation 1: Advance additional soil borings in the southeastern portion of the Former Process Area to characterize aquitard conditions.

Status: Two monitoring wells and 2 soil borings were installed in 2008 in the southeast corner of the Former Process Area. These borings confirmed that the last 100-150 feet of the sheet-pile wall in the southeastern area is not sealed in the aquitard, but in the relatively dense glacially compacted lower aquifer. Mobile NAPL was not observed in borings where the aquitard was absent indicating that this condition may not adversely impact the effectiveness of the sheet-pile wall.

Recommendation 2: Install additional groundwater monitoring wells in the Former Process Area.

Status: Additional groundwater monitoring wells were also installed in 2008. Six lower aquifer monitoring wells were installed around the perimeter of the Former Process Area to complete the lower aquifer monitoring network at the edge of the sheet-pile wall. Five lower-aquifer and three upper-aquifer monitoring wells were installed in the Former Process Area. Used in conjunction with existing wells, these new wells established 5 new vertical hydraulic containment well pairs supplementing the existing 4 hydraulic containment well pairs.

Recommendation 3: Document final remedy selection and proceed with implementation.

Status: EPA is currently re-evaluating additional source removal options for the Soils and Groundwater OU. A focused feasibility study will be produced to determine if source removal and treatment would better address the NCP's nine decision-making criteria and the general preference for treatment of principle threats.

5.2.3. West Harbor OU

No recommendations and follow-up actions were presented for the West Harbor OU.

5.2.4. East Harbor OU

Recommendation 1: Construct an exposure barrier system at the West Beach

Status: EPA constructed an exposure barrier system at West Beach in 2008.

Recommendation 2: Evaluate additional potential response actions in the North Shoal and East Beach areas as appropriate based on continued monitoring.

Status: EPA is currently conducting a FFS to evaluate potential remedial options for the North Shoal and East Beach. The most recent monitoring occurred in 2011 which included all of the East Harbor OU. Results from this monitoring may lead to future response actions including maintenance/replenishment of capped areas.

Recommendation 3: Continue to track developments in the tribal shellfish consumption and the effects of sediment contamination on fish and shellfish.

Status: The Suquamish Indian Tribe has a shellfish consumption rate of 498 grams per day. This rate is the 95th percentile of all adult respondents documented in the August 2000 *Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region.* This rate is much greater than the consumption rate of 21.5 gram per day used in the HHRA described in the ROD. Fish tissue sampling has not been conducted. Clam tissue sampling on the East Beach and North Shoal occurred in 2003 and 2011. As part of this FYR, a risk calculation was performed to determine the risk of ingestion of clam tissue at Wyckoff using the Suquamish Indian Tribe shellfish consumption rate above. This calculation is described in the Technical Assessment section (Section 7.3.1.3.1). OMMP sediment sampling also occurred in 2011. The final monitoring report summarizing the clam tissue and sediment results was made available in September 2012. Details of this report are included in the Data Review section (Section 6.2.3).

6. FIVE YEAR REVIEW PROCESS

6.1. Administrative Components, Community Notification, and Document Review

6.1.1. Administrative Components of the Five Year Review Process

The EPA Remedial Project Manager for the Wyckoff/Eagle Harbor Superfund Site Five-Year Review is Howard Orlean. The five year review team included the following personnel from the USACE Seattle District: Tom Clayson (chemist), Deborah Johnston (biologist), Sharon Gelinas (geologist), Marlowe Laubach (chemical engineer), and Maleena Scarsella (environmental engineer). In November 2011, EPA held a scoping meeting (teleconference) with the review team to discuss the Site and items of interest as they related to the protectiveness of the remedy currently in-place. A review schedule was established that consisted of the following:

- Community notification
- Document review
- Data collection and review
- Site inspection
- Local interviews, and
- Five-year review report development and review.

6.1.2. Community Notification and Involvement

A public notice announcing the five-year review for the Site was published in the Bainbridge Review on 13 January 2012. The notice provided a brief background of the Site, explained the reason for the five-year review, and invited the community to submit comments and questions regarding remedy performance via a toll-free phone number or by contacting the RPM directly. Four people contacted EPA as a result of this advertisement. A copy of the public notice is provided in Appendix F. Community comments are provided in Appendix G. The five-year review report will be made available to the public once it has been finalized. The report will also be available in the EPA Records Center in EPA Regional office in Seattle and the Site Information Repository at the Bainbridge Island Public Library.

In addition to the public notice announcing this five-year review, since the last five-year review fact sheets have been made available to the public in October 2007, August 2009, and September 2009. The fact sheet topics included:

- October 2007 – Closure of West Beach (Pritchard Park) for the construction of the EBS.
- August 2009 – Results of the ATSDR Health Consultation
- September 2009 – Notification of a public meeting regarding remedial action work in the Former Process Area

- September 2009 – Replacement of the groundwater treatment plant

6.1.3. Document Review

This five-year review included a review of relevant, site-related documents including RODs for each OU, monitoring reports, investigation reports and recent monitoring data. A complete list of the documents reviewed can found in Appendix A.

6.2. Data Review

6.2.1. Soils and Groundwater OU

Treatment Plant Performance and Compliance Monitoring

Extraction wells currently in use are PW-1, PW-2, PW-4, PW-5, PW-6, PW-8, PW-9, EW- 2 and EW-6. When the extraction system is fully operational, maximum flow rates are 57 to 60 gpm; the average extraction rate per well ranges from less than 1 to about 15 gpm. In addition to recovering groundwater, the extraction well system is designed to recover NAPL composed of both LNAPL and DNAPL. From 2007 and 2011, 5,657 gallons of NAPL were recovered.

Treatment plant performance and discharge monitoring is conducted weekly at eight sampling points within the new groundwater treatment plant. Results are used for daily operations decisions and are provided to EPA and Ecology in monthly reports. The most critical samples collected in the performance monitoring program are the samples used to evaluate differences in contaminant concentrations between the lead carbon unit and the third (lag) unit in the treatment series that consists of three carbon units operating at any time (the lead, mid, and lag units). These samples provide early warning when carbon loading is approaching the breakthrough threshold (the point where contaminants in the carbon unit effluent exceed a certain concentration) so that action can be taken before that happens. These samples also determine whether the treated effluent will meet discharge standards for these contaminants. When concentrations of PAHs and PCP leaving the lead unit are over 60% of the concentrations entering the unit, the lead carbon unit is taken offline, and is replaced in the train by the mid unit (which becomes the lead unit) and a fresh unit (that has been on standby) is put online as the lag unit. Effluent discharge limits to Puget Sound have never been exceeded.

In addition to chemical samples, biological samples are collected near the treatment plant outfall and analyzed for toxicity both quarterly and annually. Results of both the annual and quarterly biomonitoring tests have consistently demonstrated compliance with Washington State discharge limits for toxicity as described in WAC 173-205-020. The frequency specified for Inland Silversides acute toxicity testing required in the NPDES permit has been modified from quarterly monitoring (the initial permit requirement) to annual. This modification is noted in the 2005

groundwater treatment plant operations and maintenance Quality Assurance Program Plan (USACE, 2005).

Groundwater Monitoring

Groundwater monitoring is used to evaluate hydraulic containment/isolation performance and consists of water level monitoring in the upper and lower aquifers and contaminant concentration monitoring in the lower aquifer. In 2008, 16 wells were installed in the upper and lower aquifers to create new vertical well pairs for containment assessment and to complete the monitoring well network at the edge of the sheet-pile wall.

Water level data is currently assessed at 10 upper/lower aquifer well pairs: CW03/CW02, CW08/P4L, CW13/VG4L, MW14/CW05, MW18/CDMW01, PO03/CDMW02, PO13/VG1L, VG2U/VG2L, VG3U/VG3L, and VG5U/VG5L. Containment is evaluated by comparing the average water levels recorded during a monitoring period, which is typically 90 days. If the average lower aquifer elevation is greater than the average upper aquifer elevation (i.e. upward or positive gradient), then containment is demonstrated. A negative gradient indicates downward flow of groundwater from the upper aquifer to the lower aquifer and non-containment. A review of the gradient data for each monitoring period between 2007 and 2011 indicated, that overall, containment was generally demonstrated (see data presentation in Appendix E). However, there were some periods of negative gradients during 2010 when containment was not demonstrated. An evaluation of the negative gradients and cumulative precipitation between 2007 and 2011 indicated that some of the highest negative gradients occur during periods of heavy rainfall, particularly during the fall and winter months (see data presentation in Appendix E). The issues with containment in 2010 have also been associated with the new GWTP startup and initial operation. Optimization of the extraction system operation and pumping rates could improve hydraulic containment performance during the fall and winter months and assess when the system should be restarted after the extended summer maintenance period.

Contaminant concentrations in the lower aquifer are monitored to determine long-term concentration trends of chemicals of concern in the lower aquifer. Groundwater samples are collected according to the Sampling and Analysis Plan (USACE and SCS 2004 and USACE 2005); however there is no specified schedule or well list. Between 2007 and 2011, there were four sampling events: January 2008, February 2009, September 2009, and May 2010. During the last two events, 25 monitoring wells were sampled: 24 wells in the lower aquifer from the site and 1 well in the upper aquifer to assess potential groundwater migration through the hole in the aquitard in the southeast area of the site.

A summary of contaminant concentration data and time-series graphs are presented in Appendix E. From 2007 and 2011, PAHs were detected above cleanup levels in monitoring wells CW05,

CW12, CW15, PZ-13, P-3L, P-4L, VG-2L, and PZ-07 (upper aquifer). During the period of non-containment in 2010, concentrations in lower aquifer wells CW05, CW09, CW15, PZ11, VG-2L, and VG-3L slightly increased (CH2MHill 2010). A groundwater monitoring program with regularly scheduled sampling events has been implemented in order to obtain a comprehensive assessment of hydraulic containment and long-term concentration trends.

Sheet-pile Containment Wall

Two sheet-pile walls are in place at the Soils and Groundwater OU. One containment wall is placed around the outer, shore-side perimeter of the site. The wall is approximately 1,870 feet long, extends approximately 20 to 90 feet below grade, and is embedded into the aquitard layer. The thickness of this sheet-pile wall varies from 11.9 mm (0.47 inches) to 17.1 mm (0.67 inches). A second sheet-pile wall is installed within the outer containment wall area. This second wall was installed to isolate a section of the site for the purposes of the thermal remediation pilot study. Construction of both walls was completed in February 2001.

Performance of the perimeter sheet-pile wall is not monitored on a regular basis. An evaluation of the corrosion potential for the wall was conducted in 2004 (URS and CH2MHill 2004). Results show that the upper splash zone on the seaside portion of the wall has the highest corrosion rates due to the constant wetting and oxygen availability from seawater spray. During the site inspection in 2012, the sheet-pile wall along the northeastern portion of the site appeared to have the most corrosion. To ensure the long-term performance of the perimeter wall, corrosion control methods should be considered.

6.2.2. West Harbor OU

WSDOT completed construction of the CDF and the initial tidal barrier in December 1997. An additional tidal barrier along 600 feet of shoreline near the northern boundary was completed in 2006 due to persistent elevated metals concentrations in the intertidal seeps. Long-term monitoring was completed from 1998 through 2007 (Years 1 through 10) according to the 1997 OMMP. The OMMP was updated in 2008 following a review of the data collected in Years 1 through 10. A summary of the 1997 OMMP standards, performance monitoring conducted from 1998 through 2007, and the 2008 OMMP requirements is presented in Table 7.

Monitoring activities include inspection of the site BMPs and stormwater, groundwater monitoring and intertidal seep monitoring. Construction activities at the site also have the potential to impact inspections and monitoring results. During the current five-year review period (2007-2011) construction activities included: repairing and maintaining the dock facilities, Slip E, and existing utilities; rehabilitation of the existing maintenance building to

address structural, seismic, and functional needs; construction of a maintenance building annex; and repair of the floating dock at the passenger slip.

Inspections

Site and stormwater inspections are required to ensure compliance with the following objectives:

- Control direct contact exposures and associated human health risks associated with soils contained below asphalt-concrete pavement and stabilized soil layers.
- Control erosion of soils contained below asphalt-concrete pavement layers into Eagle Harbor.
- Control infiltration of precipitation and surface water run-on into soils contained below asphalt-concrete pavement layers.
- Minimize suspended solids and contaminant concentrations in future stormwater runoff discharged from WSDOT-owned properties to further protect water and sediment quality in Eagle Harbor.

Site inspections have been completed annually as required by the OMMP. A summary of the potential problems observed during the site and stormwater inspections during the five-year review period are presented in Appendix E. Site features are shown on Figure 6. All significant problems identified during the inspections have been repaired or are planned for repair when funding is available. Cracks have been frequently observed and have been repaired; however, some recent repair techniques have been unsuccessful. The need for long-term repairs or replacement of the asphalt-concrete cap should be considered.

In accordance with the storm water pollution prevention plan (SWPPP) (WSF, 2011), the OU is inspected during both wet and dry conditions for operation, source control, erosion and sediment control, and stormwater treatment BMPs. Stormwater quality samples are collected on a quarterly basis. Benchmark levels were exceeded in 2008, 2009, 2010, and 2011 for total zinc and total copper, but have been associated with improperly covered construction materials. There have been no exceedences of benchmark levels since February 2011 when construction was completed and all construction related equipment and debris was removed from the site.

Table 7. Summary of the West Harbor 1997 OMMP monitoring performance standards, performance of monitoring conducted in Years 1 through 10 (1998 through 2007), and the 2008 OMMP monitoring requirements (from Herrera, 2008b).

Monitoring Component	1997 OMMP Performance Standard	1998-2007 Performance	2008 OMMP Requirement
Inspection			
West Harbor OU	Inspect and report to ensure health advisory updates, no breaching of fencing, unobstructed northern cutoff drainage system, no cracks in asphalt, and upland excavation and piling restrictions.	Performed as required, including repaired fencing and asphalt subsidence.	Continue annual site inspections during a summer low tide.
Stormwater	Inspect and report to ensure stormwater treatment system maintenance, research, upgrade, and permit compliance.	Performed as required, including maintenance of oil-water separators.	Continue annual stormwater inspections during wet and dry conditions, and conduct additional monitoring according to current NPDES permit.
Water Quality			
Piezometers	CDF water levels remain above 10 feet MLLW, which was lowered to 8.7 feet MLLW in 1999 based on elevation of hotspot sediments.	Performed as required.	Monitor water levels in piezometers PZ-02 and PZ-03 during ground water monitoring in Years 14 and 19 (2011 and 2016).
Ground Water	Well and well point samples shall meet Washington State marine water criteria for mercury (Hg), copper (Cu), and zinc (Zn).	Performed as required except for overestimated Cu due to analytical interference, and elevated total Hg due to suspended sediment.	Monitor well MW-01 once in Years 14 and 19 (2011 and 2016) for routine field parameters and metals (Hg, Cu, and Zn). No well point monitoring is required.

Monitoring Component	1997 OMMP Performance Standard	1998-2007 Performance	2008 OMMP Requirement
Surface Water	Use as background for comparison to ground water.	Performed as required.	Monitor ravine stream once in Year 11 (2008) for Cu and Zn; additional monitoring will be conducted if contaminated seepage is observed.
Intertidal Seeps	Seep samples shall meet Washington State marine water quality criteria for Hg, Cu, Pb, and Zn.	Seep under Pier A (SP-01) met all criteria. Seeps at tidal barrier (SP-02 and SP-04/5) exceeded Cu and Zn criteria until capped in 2006; slight exceedence of Cu criteria in one seep since capping.	Inspect the seep remediation cap on an annual basis during a summer low tide, and test up to 4 seeps exceeding 1 gpm for Cu and Zn once in Years 11, 15, and 20 (2008, 2012, and 2017).
Sediment Quality			
Surface Sediment	Surface sediment samples (0-10 cm) from 10 cap stations shall meet the minimum cleanup level (MCUL) criteria for Hg.	Performed as required except for 2 cap stations in 2005 due to contamination by off-site suspended sediments and bioturbation.	No surface sediment monitoring is required.
Sediment Trap	Sediment trap samples shall meet the sediment quality standards (SQS) for mercury.	Performed as required.	No sediment trap monitoring is required.
Bathymetric Survey	Berm and cap areas shall not erode more than 0.5 feet.	Performed as required except for several small areas that may have eroded but did not compromise the integrity of the berm or cap.	No bathymetric surveys are required, but a survey may be conducted if there is a significant earthquake or cap disturbance.
Tissue Quality			
Fish Tissue	Fish tissue mercury concentrations shall be less than 0.22 mg/kg.	Performed as required.	No fish tissue monitoring is required.

Monitoring Component	1997 OMMP Performance Standard	1998-2007 Performance	2008 OMMP Requirement
Intertidal HPAH Area			
Surface Sediment	The 95th percent upper confidence limit (UCL) of sediment PAH concentrations at 10 stations shall not exceed the minimum cleanup level (MCUL) for individual and cumulative PAHs.	Performed as required.	No sediment PAH monitoring is required.
Shellfish Tissue	The 95th percent upper confidence limit (UCL) of the average carcinogenic PAH toxicity equivalency concentrations (cPAH-TEF) shall be less than 60 µg/kg wet weight.	Performed as required.	No shellfish tissue PAH monitoring is required.
Habitat Performance			
Low Tide Survey	Verify that habitat and armor materials have not eroded in the berm, cap, and tidal barrier areas, and that the habitat layer is colonized by macroinvertebrates and macroalgae.	Performed as required.	No low tide surveys are required.
Underwater Video Survey	Verify that that the habitat layer is colonized by macroinvertebrates and macroalgae.	Performed as required.	No underwater video surveys are required.

Monitoring Component	1997 OMMP Performance Standard	1998-2007 Performance	2008 OMMP Requirement
Eelgrass Monitoring	Plant and monitor eelgrass meadow in a 0.6-acre plot located immediately west of the cap.	Initial planting failed and a second planting conducted as a contingency action also failed due to excessive macroalgae growth.	No eelgrass planting or monitoring is required.
Schel-chelb Monitoring	Estuary monitoring data shall meet requirements for minimum size, soil texture, slope, conductivity, native plant cover, tree cover, invasive species cover, bird species richness and diversity, benthic invertebrate species richness, and culvert fish passage.	Performed as required.	No additional estuary monitoring is required, but WSDOT will continue to provide updated maintenance reports as needed.

Groundwater

Groundwater monitoring is conducted to verify the design parameters of the CDF. Monitoring includes measurement of water levels in two piezometers (PZ-02 and PZ-03) within the CDF to ensure that groundwater level is below the surface of the contaminated sediments (8.7 feet MLLW) and water quality monitoring at one monitoring well (MW-01) located down-gradient of the CDF. Water quality samples are analyzed for total suspended solids (TSS), total mercury, and dissolved mercury, copper, and zinc. Data are compared to the Washington State marine water quality criteria due to the hydraulic connection between groundwater under the cap and surface water in Eagle Harbor.

Piezometric data are presented in Appendix E and monitoring locations are shown on Figure 6. Water level data collected in 2007 and 2011 were above 8.7 feet MLLW. Water quality data are presented in Appendix E. With the exception of temperature in 2007, all parameters were below marine criteria and within the range of values observed since Year 1 (1998). The piezometric and water quality data indicate that the CDF continues to function as designed.

Intertidal Seeps

Water quality monitoring of the intertidal seeps located between the CDF and soil stabilization area 1 (SSA1) is required to verify that the relatively high metals concentrations detected in seepage discharged during the remedial design were sufficiently controlled during the cleanup actions. All seep sampling is performed when the predicted tide in Eagle Harbor is between -1 and +1 foot MLLW. In the event that multiple seeps are observed, the seep with the highest flow is sampled, along with up to 2 or 3 other additional seeps exhibiting the minimum and maximum salinity of those remaining seeps having a discharge rate greater than 1 gpm. Water quality samples are analyzed for TSS, and dissolved copper and dissolved zinc. Additional seep monitoring is to be conducted if unusual seep characteristics are observed during an annual site inspection. Examples of unusual seep characteristics include the presence of rust-stained sediment (indicative of mobilization of certain dissolved metals), turbid water, and excessive discharge rate (e.g., greater than 10 gpm).

Water quality data is compared to the Washington State marine water quality criteria. In the event that one or more of the seep metal concentrations exceed acute water quality criteria, then each value is compared to the 95% upper prediction interval (UPI) of the baseline conditions established after the seep-remediation–cap was constructed (October 2006 through May 2008) as described in the OMMP (Herrera 2008b). An exceedance of the UPI indicates that there is a statistically significant increase in concentrations.

Seep data are presented in Appendix E and includes all baseline seep data and data collected in 2011. Seep monitoring locations are shown on Figure 7. Baseline metals concentrations are well below concentrations observed prior to 2006. Concentrations of dissolved copper in baseline seep data ranged from 1.36 to 6.33 µg/L, with a mean of 3.2 µg/L and UPI of 6.6 µg/L. Concentrations of dissolved zinc ranged from 2.18 to 19.63 µg/L, with a mean of 9.13 µg/L and UPI of 21.1 µg/L. There were slight exceedances of the marine water quality criteria for dissolved copper concentrations during the baseline monitoring in 2007; however, the magnitude of the exceedance and the dilution of the seep by stream waters indicate that these copper concentrations should have no impact on aquatic biota.

Long-term seep monitoring data collected in 2011 show that there was one exceedance of the marine water quality criteria at location SP-12. The detected copper concentration, 5.38 µg/L, is lower than the baseline data UPI indicating that it is not significantly different than baseline conditions. All other metal concentrations were below marine criteria. The marine water quality criteria for temperature was not met in 2011; however, the temperatures measured are within the range measured during the baseline sampling. The long-term seep monitoring data indicate that the seep-remediation-cap is continuing to function as designed.

6.2.3. East Harbor OU

Several sediment caps are monitored as part of the OMMP; Phase I constructed in 1994, Phase II constructed in 2000, Phase III constructed in 2001, and the EBS constructed in 2008. Additional areas are also monitored. These areas are presented in Figure 9 and include:

- North Shoal – This consists of the intertidal area on the north shore of the former Wyckoff facility. It is bounded to the west by the intertidal cap and to the east by East Beach.
- East Beach – This consists of the intertidal area on the eastern side of the former Wyckoff facility. It is bounded by the North Shoal and extends south to the Wyckoff property boundary.
- West Beach – West Beach (formerly known as the Mitigation Beach) lies at the western edge of the Wyckoff facility property and encompasses both the EBS and the riparian habitat upland from the intertidal EBS.

The 2011 OMMP provides the monitoring requirements for the areas identified above. Monitoring objectives were described in Section 4. To determine the physical stability of the cap, monitoring included bathymetry of the subtidal caps, beach elevation surveys to review the stability of intertidal structures at East Beach and the North Shoal, grain-size distribution surveys, and sediment-transport modeling to increase the understanding of coastal sediment erosion. Figures 10 through 12 show the physical stability sample locations.

To determine contamination isolation, surface and subsurface sediment sampling was conducted in the subtidal cap and intertidal areas. To determine natural recovery, visual inspection and sampling of intertidal seeps was also conducted in the North Shoal and East Beach areas. Figures 13 through 17 show the chemical analysis sample locations, including surface and subsurface stations throughout the East Harbor OU.

To determine effectiveness of the remediation as a functioning habitat, limited biological monitoring was also conducted. Clam tissue sampling was conducted in 2011 as described below. A survey of the use of intertidal and subtidal cap areas by forage fish and habitat use surveys were completed since the last FYR. Figures 18 through 21 show the locations of the habitat surveys.

The Final 2012 Monitoring Report (HDR 2012) provided results from the monitoring conducted from June 2011 through November 2011 in accordance with the 2011 OMMP. USACE conducted a clam survey of the East Beach, North Shoal, and West Beach in May 2011. In addition to these two studies, the University of Texas investigated PAH concentrations in pore-water at different depths in the subtidal caps to examine the transport of contamination into the biologically active surface water area (Thomas, et. al, 2012) in November 2011. The following presents a summary of the results from these studies.

Appendix E presents all the data summarized below.

Subtidal Caps (Phases I and II)

Physical stability

Per the Final 2011 Monitoring Report (HDR 2012), the northern and southern sections of the subtidal cap are physically stable, and generally have remained at the target thickness (three feet of cover thickness). This conclusion is based on the bathymetric profiles, cap thickness measurements from the sediment cores, and results of the sediment mobility analysis modeling. The bathymetric contours comparing 1999 to 2005 (Figure 23) reflect placement of material from both construction of the Phase II/III cap and likely from natural depositional processes. Comparison of bathymetric contours from 2005 and 2011 show additional material accumulation on top of the Phase II cap. The Phase II cap area meets or exceeds the target remedial goal of 3 ft of cover material (Figure 24). Figure 22 shows the elevations changes between 1999 and 2011 and the cap thickness measured in 2011.

An area within the central Phase I cap identified by stations F-7, F-9, G-8 and I-8 has less than 2 ft of Phase I cap material - less than the remedial target thickness. The Year 8 monitoring also noted that G-8 was below target cover levels. The 2011 monitoring results suggest no further erosion has occurred based on 2011 bathymetry results and core evaluation at G-8. A comparison of core thickness at G-8 from past monitoring events shows that the thickness has remained the

same since at least 1997. Despite the fact that stations F-7, F-9, and I-8 were not evaluated in 2003, the 2011 bathymetric data suggest that this area has remained stable since 1999.

The northern section of the Phase I cap, stations H-2 through M-2, appear to be stable and remain at the desired thickness as shown in Figure 24. The bathymetric comparisons show both erosional and depositional areas, but overall the trend is depositional with apparent net accretion of sediment. Cores collected at H-2 and J-2 showed cover material equal to or greater than the target goal of 3 ft.

The areas immediately proximal to the ferry lane (grids E-3 through I-3, and G-4 through J-4) are not physically stable and do not have cap material at the target remedial goal. The bathymetric profiles (Figure 23) clearly indicate areas of erosion around the ferry lanes that occurred between 1999 and 2005; since 2005 that same area remains stable (Figure 24). This is further supported by the complete absence of capping material at H-4 and G-4 and less than 1 ft of material at J-4. Since 1998, erosion has been recognized within this so-called "scour zone", but the full extent of that was not previously identified. The Year 8 monitoring event did not include monitoring in the northern cap. The bathymetric data and the sediment mobility analysis modeling indicate that most of the observed scour occurred prior to the 2005 bathymetric survey. The 2011 survey did not show any additional significant erosional or depositional areas.

Sediments at station J-9 may not be physically stable, and do not have the requisite cover thickness. Three of the four coring locations exhibited complete lack of cover material (J-9b, J-9c and J-9d), while J-9a had only 1.2 ft of Phase II/III capping material. Whether this lack of cap material is due to erosion or because J-9 did not receive either Phase I or Phase II cover material remains a question. Grid J-9 is outside both the Phase I and Phase II cap boundaries. The absence of Phase I cap material in the cores suggest that J-9 was not included in the 1994 cover operation. Figure 22 shows the measured cap thickness relative to the capping boundaries, and the 1999 – 2005 bathymetric comparison. While elevation gains of up to five (5) ft within the Phase II cap boundary (Figure 22) are evident, within Grid J-9 at three of the four core locations no elevation gains are shown. Results of the sediment mobility analysis suggest that there is not sufficient tidal, wind-wave, or ferry-induced wave energy to mobilize and erode the Phase II/III cap material. One additional possibility is that material was placed, but was not stable on the slope at J-9, and sloughed off into deeper water. However, the slope at J-9 is 0.12 ft rise for every foot of run. The Phase II course sand/fine gravel is generally stable until slopes of 3:1 are exceeded. The collective body of evidence suggests that J-9 was not adequately capped by the 2000 cover event.

J-10 samples appear to be physically stable, with target cover thickness met in two of the three cores. The bathymetric profiles show accumulations over grid J-10 of up to 5 ft from 1999 – 2005, reflecting the thickness of the cover material placed in the Phase II cap. Of the three cores

collected, J-10a and J-10c had cover thickness of 2.8 and 4.4 ft, respectively, while J-10b had 1.3 ft of cover material.

Effectiveness of Cap Isolation

Per the Final 2011 Monitoring Report (HDR 2012), subtidal caps are effectively isolating the underlying contaminant sediments, with the exception of stations within the ferry lane scour zone. This is shown from the results of 20 surface sediment sample and 14 through-cap core samples. Only three of the 20 surface samples exceeded the SQS (stations G-4, H-4, and I-4) and these were located within the ferry scour zone. All other areas of the subtidal caps met the surface sediment target remedial goals (concentrations less than the SMS standards for PAHs, dibenzofuran, and pentachlorophenol.) Surface and subsurface sediment results are shown in Figures 25 and 26.

For the J-9 grid cell, the cap may not effectively isolate the underlying contaminated sediments in the long term. Though all surface samples at J-9 had no detected analytes that exceeded SQS, either no cover was present or only 1 foot of cover was present at these sample locations. Core samples showed NAPL present within 1 – 2 ft below mud surface.

At grid J-10, the cap appears to be effectively isolating the underlying contaminated sediments. There were no exceedances of the SMS in surface sediment samples. Results for grid J-9 and J-10 are shown in Figure 27.

From the University of Texas study, "In general, only surficial samples that exceeded screening criteria may be of concern in that only these samples are exposed to surface water and benthic organisms. No surface water or near-surface porewater sample concentrations exceeded surface water quality standards (SWQS). One porewater concentration measurement was in exceedance of SWQS, benzo[a]pyrene at Location J-9 at a depth of 33 inches below the surface. The measured concentration was 41 ng/L (SWQS of 18 ng/L)" (Thomas, et.al, 2012).

Intertidal Cap

Physical stability

The intertidal Phase III cap is physically stable based on the comparison of the 2005 and 2011 bathymetry which show the area is either stable or depositional over that time frame. No cores or cover thickness measures were made in the intertidal cap; therefore no assessment was made of whether the cap remained at the design thickness. Elevation differences are shown in Figures 22 through 24.

Effectiveness in contaminant isolation

All analyses of the cover material were below both the SQS and the ROD-defined human health risk criteria.

Habitat Use

The intertidal cap provides habitat for clams, invertebrates, macroalgae, forage fish, and birds. Clams were identified in this area and tissue was analyzed in the 2011 clam tissue sampling effort (USACE 2012). A previous clam survey was conducted in 2003. However, comparisons of PAH levels from the 2003 and the 2011 sampling could not be performed because the quantitation limits in the 2003 analyses were much higher than those in 2011. It is recommended that an additional clam tissue collection occur to provide data for a time-trend of increasing or decreasing exposure to PAHs at the Site.

Exposure Barrier System

Physical stability

The EBS may not have achieved physical stability; particularly in the lower intertidal areas. There is an apparent loss between 1-2 ft in the lower intertidal zone and material gains of 2 ft in the upper intertidal zone as shown in Figure 28. However, all of the low intertidal stations with field cover measures showed greater than 1 ft of cover thickness. (Figure 29). The four stations where there was less than 1 ft of material were in the high intertidal area at the upper edge of the fill area, where the habitat fill merged with the existing beach (Figure 29).

Effectiveness in contaminant isolation

All chemical analyses of the cover material were below the SQS and the ROD-defined human health risk criteria.

Habitat function

Clams were generally not observed in the EBS and very few forage fish were found; and fewer invertebrates. The 2011 and 2012 forage fish spawn survey determined that, for the two dates surveyed, the area is currently utilized by spawning and sand lance and to a lesser extent surf smelt. Data is limited to determine whether the EBS is providing functional habitat to marine aquatic organisms. (HDR 2012). Further monitoring would be needed to determine whether the EBS is providing functional habitat.

North Shoal/East Beach

Physical Stability

The overall trend at both the North Shoal and East Beach is that both areas remain physically stable (Figure 23 and 24). For the North Shoal, areas of erosion are indicated in the subtidal area from 1999 – 2005 (Figure 23), and accretions of sediment in those same areas from 2005 and 2011 (Figure 24). The North Shoal intertidal area shows neither erosion nor accretion between 1999 and 2011. Whether these apparent elevation gains/losses in the subtidal area reflect real

physical processes or are an artifact of the survey and topographic modeling error is not clear, but it can be concluded that the overall trend is that there is no net loss or gain of sediments at the North Shoal.

East Beach has remained stable between 1999 and 2011. Neither erosion nor accretion is indicated in the elevation surveys (Figures 23 and 24).

Natural Recovery

Natural recovery is occurring on North Shoal. In the 10 years since control of sources, natural recovery has achieved a 97 percent reduction in surface sediment PAH levels. With the exception of areas in grid cell K9, (defined by grid sub-cells K9-B4 and K9-D3 (Figure 14)), the North Shoal has achieved the natural recovery cleanup goal of having contaminants at levels below the human health cleanup goals and the SMS/MCUL within 10 years of source control.

Thus, North Shoal has met the ROD-defined natural recovery cleanup goal of HPAH concentration of 1,200 mg/kg and PAH concentrations below MCUL within 10 years of source control, except at K9-B4 and K9-D3. At these areas, additional time will be needed to achieve natural recovery goals. Figure 30 shows the North Shoal results.

Natural recovery is occurring at East Beach. Surface sediment PAH concentrations have declined by one or more orders of magnitude between 2003 and 2011. Only two surface stations on the northernmost transect (M10-E4 and N10-A4) exceeded human health cleanup goals and the SMS/MCUL within 10 years of source control. The subsurface sediments at East Beach still contain residual hydrocarbon in M10-E4, N10-A4, N11-A2, and N11-B5 (Figure 14). NAPL-bearing strata were observed in the cores and elevated PAH concentrations were measured. There were no substantial differences in the extent and concentrations of subsurface PAHs between 2003 and 2011.

Thus, East Beach has met the ROD-defined natural recovery cleanup goal of HPAH concentration of 1,200 µg/kg and PAH concentrations below MCUL within 10 years of source control, except at M10-E4 and N10A-4. This area will require more time to achieve natural recovery goals perhaps due to the continued presence of subsurface hydrocarbons. East Beach sampling results are shown on Figures 30 and 31.

Habitat Function

The North Shoal and East Beach are providing habitat for birds, invertebrates, and macroalgae. Clams were identified in this area and tissue analyzed in 2011. A previous clam survey was conducted in 2003. However, comparisons of PAH levels from the 2003 and the 2011 sampling could not be performed because the quantitation limits in the 2003 analyses were much higher

than those in 2011. It is recommended that an additional clam tissue collection occur to provide data for a time-trend of increasing or decreasing exposure to PAHs at the Site.

6.3. Site Inspection

A site inspection of all three OUs for the Wyckoff/Eagle Harbor Superfund Site was conducted on 14 February 2012. The site inspection was conducted by the USEPA and the USACE Seattle District and coordinated with the Washington State Ferries, who is the current property owner at the West Harbor OU, and the Washington Department of Ecology. Personnel from the Washington State Ferries and the Department of Ecology also participated in the site inspection.

The inspection began at the West Harbor OU with an overview of the OU, remedial activities, and current operations and maintenance activities prior to a site walk of the asphalt-concrete pavement layers, CDF and associated monitoring wells, and shoreline barrier. Seals in the cap were observed to be cracking at the pavement seams. Overall, the West Harbor OU appears to be functioning as intended.

The inspection continued to the Soils and Groundwater OU with an overview of the OU, the groundwater treatment system operation and maintenance, and site walk of the groundwater treatment plant, extraction and monitoring wells, and the former site of the old groundwater treatment plant. The fully automated treatment plant includes remote control capabilities allowing the operators to restart the system outside of business hours without having to go to the site. The extraction wells used to maintain hydraulic control and extract contaminated water are adjusted manually. Also NAPL is pumped and manually transferred to the product tank in the treatment plant. Groundwater wells were last sampled in May 2010; however, another sampling event occurred in June 2012. There is no specific sampling frequency for the monitoring wells. Although the full remedy hasn't been implemented, overall the Soils and Groundwater OU appears to functioning as intended.

The inspection ended with the East Harbor OU. The group inspected the West Beach, East Beach and North Shoal. At the East Beach, a new park area and marine life were observed. Also observed at the East Beach were creosote odors and flaking rust from the sheet-pile wall. At the North Shoal area the group observed flaking rust from the sheet-pile wall, although not as prominent as at the East Beach, and some graffiti. In the area of the former West Dock area, noticeable sheen was observed. No creosote seeps were observed at the East Beach and North Shoal areas during the time of the inspection. The West Beach area, currently part of Pritchard Park, was noticeably different in appearance from the East Beach and North Shoal areas with more sand and no stones and minimal seaweed and marine animals. No creosote odors or seeps

were observed during the inspection of the West Beach area. The rest of the East Harbor OU lies within the harbor and was not inspected.

See the Site Inspection Checklist (Appendix B) for details of the inspection and a roster of attendees. Site inspection photos are presented in Appendix C.

6.4. Interviews

During the five-year review process, interviews were conducted with parties involved with or otherwise interested in the Site, including property owners, regulatory agencies and local Tribes involved in Site activities, community advocates and local residents. The purpose of the interviews was to document the perceived status of the Site and any perceived problems or successes with the phases of the remedies that have been implemented to date. The interviews were conducted between 18 April and 23 May, 2012. The common themes and more important issues brought up during the interviews are summarized below and complete interview transcripts are included in Appendix D.

In general interviewees were pleased with what has occurred in the last five years to include the removal of the old treatment plant and construction of the new treatment plant, the EBS placement, and the new road. State and local government and the Suquamish Tribe were kept informed of the progress and are generally pleased with the current management of the work performed at the Site. Ecology and community interviewees expressed the concern of NAPL remaining on-site and the implementation of the contingency remedy for the Soils and Groundwater OU. They feel a more active remediation is needed to remove the NAPL that remains on-site. One community interviewee expressed concern over the integrity of the sheet-pile wall especially as the Site is within a fault zone. Community interviewees would like a public meeting to update the community of the progress being made at the Site. The Suquamish Tribe expressed concern of remaining PAH contamination within and adjacent to East Beach area in the East Harbor OU. However, they are supportive of EPA's planned activities in this area.

7. TECHNICAL ASSESSMENT

7.1. Question A: Is the remedy functioning as intended by the decision documents?

7.1.1. Soils and Groundwater OU

Overall, the containment remedy is largely functioning as designed. The aging GWTP has been replaced. The new plant was completed in 2009 and went online in April 2010. Monitoring has generally demonstrated that the groundwater extraction system is providing hydraulic containment; however, there have been instances during periods of heavy precipitation where containment was not demonstrated because contaminated groundwater was moving from the upper aquifer to the lower aquifer during these periods. Recent monitoring, in 2011, indicates that containment is currently being met. The sheet-pile wall is showing signs of corrosion in the splash zone. Corrosion protection for the sheet-pile wall, installation of the cap to control infiltration and maintain containment, and the remaining ICs should be implemented.

7.1.1.1. Remedial Action and Performance

Extraction and Treatment. Groundwater is currently extracted at 7 wells and is treated at the new GWTP. Weekly performance and discharge monitoring show that effluent discharge limits for Puget Sound and NPDES requirements are being met. In addition to the extracted and treated groundwater, 5,657 gallons of NAPL have been recovered from 2007 and 2011.

Hydraulic containment is assessed using water level data collected in upper and lower aquifer well pairs and contaminant concentrations in the lower aquifer. Overall, water level data demonstrate that containment is met; however, during 2010 there were periods of negative gradients or downward flow potentials. Negative gradients have been associated with periods of heavy precipitation. In addition, initial operations of the new GWTP in 2010 may have contributed to the lack of containment during this time period. Contaminant concentration increases in the lower aquifer during the 2010 sampling event also indicated a loss of containment during this time period.

Sheet-pile Wall. Performance of the sheet-pile wall is not monitored on a regular basis. Borings installed in the southeast area of the site in 2008 confirmed that the last 100-150 feet of the sheet-pile wall in the southeastern area is not sealed in the aquitard, but in the relatively dense glacially compacted lower aquifer. Mobile NAPL was not observed in borings where the aquitard was absent indicating that this condition may not adversely impact the effectiveness of the sheet-pile wall.

7.1.1.2. Opportunities for Optimization

Hydraulic Control. Monitoring data indicate that heavy precipitation and operation of the extraction system impact hydraulic control at the site. Optimization of the extraction system should be completed to ensure consistent hydraulic containment. This could include an evaluation of the required extraction rates and operational times to maintain control during the fall and winter months when precipitation is greatest. Extraction well performance should also be assessed to determine if there are potential issues with screen fouling or failure. Infiltration control, such as a cover system may also be necessary in order to maintain hydraulic containment at the site. A regularly scheduled, rather than intermittent, groundwater chemical monitoring program for the lower aquifer should be implemented to confirm that hydraulic control is maintained and determine if there are any long-term concentration trends.

Sheet-pile Wall. The sheet-pile wall is showing signs of corrosion in the splash zone, particularly the northeast portion. Corrosion protection for the wall should be implemented.

Remedial Alternatives. In 2010, the Washington State Department of Ecology prepared a Generational Remedy Evaluation exploring remedial alternatives that would significantly reduce the volume and mobility of contamination at the site thereby reducing the reliance on hydraulic containment and lowering future operation and maintenance costs (Floyd|Snider and Aspect Consulting 2010). EPA is currently in the planning stages for a Focused Feasibility Study to evaluate additional remedial alternatives.

7.1.1.3. Implementation of Institutional Controls

The ROD required institutional controls to ensure that the both the upper and lower aquifers remain unused as a source of drinking water and to reduce the risk of direct exposure to surface soil. The upper aquifer within the Former Process Area is not potable due to high salinity levels; the upper aquifer outside the Former Process Area and the lower aquifer have the potential to be used for consumption. The Former Process Area has a fence around the perimeter to limit exposure to contaminated soils. A "Notice of Agreement and Covenants Affecting Real Property" (Notice and Covenants) document, where the City of Bainbridge Island is the grantor and EPA is the grantee, includes an institutional control stipulating that the settling respondent (City of Bainbridge) shall not install wells nor withdraw, nor allow third parties to withdraw, groundwater from the Soil and Groundwater OU unless otherwise agreed to by EPA. The Notice and Covenants are recorded and on file with Kitsap County.

7.1.1.4. Early Indicators of Potential Issues

The State of Washington has objected to full implementation of the containment contingency remedy for the Soils and Groundwater OU. The soil cap has not been designed or placed. In accordance with a current agreement between EPA and the State, the State has taken over

operation and maintenance of the groundwater extraction and treatment system for a period of two years (April 2012 through April 2014) and EPA is conducting a Focused Feasibility Study to evaluate additional source removal options for this OU.

7.1.2. West Harbor OU

The remedy is currently functioning as designed. The asphalt cap, BMPs, CDF, and tidal barrier performance are being monitored. Performance standards are currently being met and are documented in the quarterly and annual monitoring reports. Institutional controls are in place to control contact with contaminated soils and consumption of marine organisms in Eagle Harbor.

7.1.2.1. Remedial Action Performance and Operations

Site and stormwater inspections and are used monitor the asphalt cap, stormwater runoff, and control direct contact exposures and associated human health risks. Cracks are frequently observed in the cap. Crack repairs have been completed, but some recent repair techniques have been unsuccessful. Groundwater monitoring is used to verify that the CDF remains protective. Water level and water quality data indicate that the CDF continues to function as designed. Intertidal seep monitoring is used to verify that the tidal barrier is controlling elevated metals concentrations detected during the remedial design. All water quality data were below the UPI of the baseline conditions established after the seep-remediation-cap was constructed.

7.1.2.2. Opportunities for Optimization

Due to the frequent cracks observed in the asphalt cap and recent problems with repairs, long-term repairs or resurfacing of the asphalt cap should be considered to ensure that infiltration of precipitation and surface water run-on are controlled.

7.1.2.3. Implementation of Institutional Controls

Institutional and engineering controls consist of warning signs and/or health advisories, deed restrictions, and site access controls. Health advisories were instituted within certain shoreline areas of the West Harbor OU to minimize human health risks associated with the consumption of marine organisms in Eagle Harbor. The 2009 ATSDR study concluded that at the WSDOT facility, contact with remaining contaminants at the facility will not harm human health. Harvesting and eating shellfish is still not recommended due to a lack of data on cancer-causing PAHs, metals, and microbes. Deed restrictions were put in place to ensure the containment areas are not disturbed, wells are not installed, and only industrial uses are allowed in the upland area where contaminated soil remains on-site. The deed restrictions are reiterated in any lease agreements administered by Washington State Ferries (WSF). Site access controls primarily consist of fencing around the perimeter of the upland area and are inspected annually. The fence

was damaged in 2007 by a falling tree and was repaired. Appendix H presents the title search review report for the West Harbor OU which was performed as part of this review.

7.1.2.4. Early Indicators of Potential Issues

There are no early indicators of potential issues at the site.

7.2. East Harbor OU

Overall, the remedy is functioning as intended. The subtidal, intertidal, and EBS caps are monitored according to the OMMP to determine cap stability, effectiveness of contaminant isolation, natural recovery, and habitat use. The area of the subtidal cap within the ferry navigation lane does not have cap material thickness at the target remedial goals, and may be ineffective in isolating underlying contaminated sediments.

7.2.1. Remedial Action Performance and Operations

The Intertidal Cap remains within target thickness, shows effective contaminant isolation of underlying contaminated sediments and provides habitat for a number of species.

The EBS may not have achieved physical stability particularly in the lower intertidal areas with potential losses of habitat fill in the lower intertidal areas and material gains in the upper intertidal zones. Material replacement may be required in the future to maintain physical stability, and future monitoring will be needed to assess whether bathymetry and actual habitat fill thickness is changing. All chemical analyses of cover material were below the SQS and ROD-defined human health risk criteria showing effective contaminant isolation of underlying contaminant sediments. Clams were generally not observed on the EBS and there were few forage fish and fewer invertebrates. Forage fish, including sand lance and surf smelt are using the EBS area for spawning. Additional monitoring would be needed to determine whether the EBS is providing functional habitat.

Natural recovery is occurring at the North Shoal though additional time is required near K9-D3 and K9-B4. Natural recovery is occurring at East Beach though additional time is required near M10-E4 and N10-A4. Subsurface sediments still contain residual hydrocarbons. A focused remedial action may be required to address subsurface sediments. However, any actions would need to consider effects on the established habitat, and the efficacy of remediating stringers of NAPL in subsurface areas of the beach.

The areas of the subtidal cap within the ferry navigation path do not have cap material thickness at the target remedial goal of three feet. Because of this, underlying contaminated sediment is no longer isolated. Repair of the cap in these areas will ensure protectiveness of the remedy. In

addition, grid cell J-9 does not have cap material thickness at the target remedial goal, and may not have received capping material originally. No detected contaminants exceeded SQS at the surface, however, NAPL was present in all cores samples within 1 – 2 feet below mud surface. Additional material placed in the future within grid cell J-9 will ensure effective contaminant isolation in this area.

7.2.2. Opportunities for Optimization

The last monitoring event prior to 2011 occurred in 2002. A monitoring event was scheduled for 2006, however, this was deferred to 2011. Establishing a regular frequency of monitoring should be considered, which may vary depending on the area. For example, more frequent monitoring of the EBS thickness and more information on forage fish use and timing, in addition to an advance plan for maintenance, would be optimal to avoid rushed emergency repairs of the EBS.

7.2.3. Implementation of Institutional Controls

Institutional controls for East Harbor OU includes health advisories to increase public awareness of seafood contamination and requires periodic monitoring of seafood contaminant levels. Institutional controls also include use/access restrictions.

Health advisories. Signs are posted on the fence surrounding "the Point" (the former Process Area) warning against the harvesting and consumption of contaminated fish and shellfish. Because the signage is on the fence, these warnings may not be seen during low tides as the beach elevations are considerably lower than the fence. Clam sampling occurred in 2003 and 2011. The results of the 2011 clam sampling are summarized in Section 6 above. Because of the differences in quantitation limits between the 2003 and 2011 analyses, time-trend analyses cannot be performed to determine whether there is increasing or decreasing contamination in clam tissue. It is recommended that additional clam tissue be collected and analyzed within the next three to five years.

Use/Access Restrictions. The West Beach is part of Prichard Park and is open to the public. Access to the East Beach and North Shoal remains open to the public at low tides. No signage is present warning of contamination hazards in these areas; only signage to keep off beach. However, the signs to keep off beach may not be seen at low tide. There is signage advising against anchoring in the nearshore area. In addition to the no-anchor requirement, the Notice and Covenants described in Section 7.1.1.3 above, also applies to the East Harbor OU and includes a restriction that the settling respondent (City of Bainbridge Island) "shall not alter, modify, or remove any existing structures or caps implemented or installed as environmental response action or such structures or caps which may come to exist as a result of future remedial action at

the Site, in any manner that may damage or adversely affect the integrity or function of any structure or cap."

7.2.4. Early Indicators of Potential Issues

The subtidal cap areas where cap thickness does not meet target remedial goals of 3 feet of cover material (ferry navigation lane) may show an early indication of ineffective chemical isolation. Repair to these areas would ensure protectiveness of the remedy. The subtidal cap area within grid cell J-9 does not meet target remedial goals and may not have been capped originally. However, this area currently does not exceed SQS in surface sediment samples even though core samples show NAPL is present below surface. Placement of material in grid cell J-9 may be required in the future to ensure chemical isolation of contaminated sediments.

7.3. Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup levels, and RAOs used at the time of remedy selection still valid?

7.3.1. Exposure Assessment

The ROD for each OU identified exposures and associated risks. This five-year review evaluates whether these exposure pathways are still valid and/or if new pathways are present.

7.3.1.1. Soil and Groundwater OU

A human health risk assessment (HHRA) was summarized in the ROD. The HHRA identifies trespassers and workers with health and safety training as individuals who are potentially exposed by direct contact to contaminants. The HHRA evaluated future residential exposures through ingestion of contaminated groundwater and inhalation of volatile organic compounds released from groundwater.

The potential exposures identified in the HHRA are still valid with respect to trespassers and on-site workers. The Soils and Groundwater OU is currently co-owned by the City of Bainbridge Island and the Bainbridge Island Metro Park and Recreation District. Plans call for Pritchard Park (currently encompassing the West Beach area and the hillside south of the existing Soil and Groundwater OU) to be extended to include the Former Process Area (also known as the Point) once the remediation of the area is completed. Therefore it is unlikely this area will be inhabited by residents in the future.

7.3.1.2. West Harbor OU

The exposure pathways identified in the West Harbor OU ROD are shown in the following table.

Table 8. West Harbor Exposure Pathways in ROD

Media	Exposure Pathway	Receptor
Intertidal sediments at residential beach	Ingestion Dermal absorption	Residents
Intertidal sediments at industrial beaches	Ingestion Dermal absorption	Workers or visitors
Intertidal sediments at public beaches	Ingestion Dermal absorption	General public
Shellfish at residential beaches	Ingestion	Residents
Shellfish at industrial beaches	Ingestion	Workers or visitors
Shellfish at public beaches	Ingestion	General public
Pelagic or bottomfish in deeper waters in Eagle Harbor	Ingestion	General public

The exposure pathways identified above are still valid. The intertidal sediments at the West Harbor OU have been mitigated with a barrier system preventing exposure to contaminated sediments. Fish advisories have been implemented to prevent receptors from ingesting shellfish and bottomfish located within the harbor.

7.3.1.3. East Harbor OU

The exposure pathways identified in the East Harbor OU ROD are the same as those identified in the West Harbor OU ROD (Table 8). Areas of the East Harbor OU have been addressed (West Beach, subtidal and intertidal caps) preventing exposure to receptors. Although there are fish advisories and signs warning of harvesting and consuming shellfish and bottomfish, the general public can still access areas of ongoing natural recovery (East Beach and North Shoal).

7.3.1.3.1 Risk Calculations for East Harbor OU

A risk calculation for the ingestion of clams was completed using the clam tissue data from 2011 in the East Harbor OU area. This calculation was based on Suquamish seafood ingestion rate (Table B-2 EPA Tribal Framework-2007). The East Harbor ROD (1994) used a consumption rate of 95.1 grams per day of fish and a shellfish consumption rate of 21.5 gramps per day. The Suquamish shellfish consumption rate for shellfish of 498.4 grams per day (represents 65 percent of the diet) is used in this updated risk calculation. The Suquamish shellfish consumption grouping includes various clams, oysters, and scallops while this risk calculation is solely based on horse clam tissue cPAH TEF values. Toxic equivalence factors (TEF) are estimates of compound-specific toxicity relative to the toxicity of an index chemical (in this case benzo(a)pyrene). Several of the parameters used in this calculation are updated from the ROD: exposure frequency is expressed in days/year compared to previously it was expressed as meals/year; exposure duration in years is 70 years compared to previously 57 years (for adults);

body weight is 79 kg based on the Suquamish data compared to previously 70 kg; and ingestion rate of 498.4 g/kg/day compared to 0.151 kg/meal (52 meals/year). This risk analysis includes non-detect data (0.5*RL or Kaplan-Meier) and provides a calculation for a child risk. It is unknown if the previous calculations used non-detect data.

The EPA standard procedure for calculating exposure point concentrations includes the use of non-detect values. The use of the Kaplan-Meier (K-M) procedure has been used in regional programs since 2008 and is encouraged by EPA when using Pro-UCL. Nondetect values are either calculated using 0.5 reporting limit or as 0 and both values run. The K-M estimate falls between the ND=0 and ND=0.5RL estimates. For this instance, it was determined that using a ND=0 would overestimate risk so ND=0.5RL was used in the calculation for adults. Therefore, using the K-M for the child calculation would give a more conservative estimate of risk.

The 1994 East Harbor OU ROD found that "For seafood ingestion, calculated cancer risks are generally between 1E-6 and 1E-4 at both Eagle Harbor and background locations. For the East Harbor, specifically, cancer risks in the 1E-3 range were associated with clam tissues from beaches adjacent to the Wyckoff Facility." These beaches include the North Shoal and East Beach areas. For this review, a revised risk calculation was run using the TEF horse clam tissue collected from the Intertidal Beach which is located northwest of the Former Process Area, the North Shoal, and East Beach areas in 2011. For these areas, the risk using the updated parameters found that the adult risk would be 2.0 E-4 for adults and 3.E-4 for a child using non-detect data as 0.5*RL. Using the Kaplan-Meier summation, the adult risk for these areas would be 1.4 E-4 and a child would be 2.2 E-4. While these values are greater than the EPA acceptable risk criteria range of 1E-6 to 1E-4 they are less than the 1E-3 range documented for these areas in the 1994 East Harbor ROD.

7.3.1.4. ATSDR Health Consultation

The ATSDR published a health consultation in 2009 which determined whether current and future activities at the Site present potential public health concerns from exposure to contamination remaining at the Site. The consultation concluded that most of the areas of the Site are safe to use and continued development of Pritchard Park can proceed without placing residents or recreationalists at increased risk of exposure to hazardous levels of contamination. Exceptions included "the Point" (the Former Process Area) and the East Beach and North Shoal where contaminants remained at unacceptable levels in some locations. The report stated "Harvesting and eating of shellfish is still not recommended due to the lack of data on cancer-causing PAHs, metals, and microbes."

The 2009 ATSDR Health Consultation mentioned that the Suquamish Tribe was collecting additional geoduck samples for analysis. The geoduck analytical results were incorporated in a health assessment published in July 2009 by the Washington State Department of Health (WDOH). The WDOH assessment concluded that ingestion of commercially harvested geoduck within the two commercial geoduck tracts east and adjacent to the Site is unlikely to result in exposure to harmful levels of organic and metal contaminants.

7.3.2. Ecological Risk

7.3.2.1. Soil and Groundwater OU

The upland portion of the Soils and Groundwater OU is inside a fenced area where extraction wells remove NAPL and contaminated groundwater. Groundwater is currently extracted at 7 wells and is treated at the new GWTP. During the February 14, 2012, site visit, observed vegetation consisted primarily of ruderal grasses, small shrubs, and noxious weeds. Usage by geese was confirmed by numerous droppings in some areas of the OU. Despite the use by geese, the remedy continues to provide protection to ecological species.

7.3.2.2. West Harbor OU

Intertidal seep monitoring is used to verify that the tidal barrier is controlling elevated metals concentrations detected during the remedial design. All water quality data were below the UPI of the baseline conditions established after the seep remediation cap was constructed. The area occupied by the WSDOT ferry property is entirely hardscaped in the upland portion. The shoreline area consists of riprap and gravels to minimize seepage. Intertidal seep monitoring is used to verify that the tidal barrier is controlling elevated metals concentrations detected during the remedial design. Current conditions indicate an increase of seeps along the riprap section near the ferry terminal building. Monitoring should continue to ensure that seep chemical concentrations are below those levels that would cause harmful impacts to aquatic species. The remedy continues to provide protection to ecological species.

7.3.2.3. East Harbor OU

The East Harbor OU has had two subtidal caps placed to reduce contaminant exposure to aquatic species. Per the final 2011 Monitoring Report (HDR 2012), the subtidal caps are generally physically stable and/or remain at the target thickness, with the exception of areas proximal to the ferry navigation lane. Areas capped within the ferry navigation lane are not physically stable and clearly do not have cap material thickness at the target remedial goal. Similarly, the subtidal caps are effectively isolating the underlying contaminated sediments, with the exception of the ferry lane scour zone stations. In these areas, surface contamination is present at concentrations greater than SMS, providing an exposure pathway to aquatic species. All other areas of the

subtidal cap met the surface-sediment target remedial goals (concentrations less than the SMS standards for PAHs, dibenzofuran, and pentachlorophenol).

To provide context on the effectiveness of the original subtidal caps, resident English sole collected in the area adjacent to the East Harbor OU from 1983 to 1986 had an 80 percent prevalence of toxicopathic liver lesions (Myers et al 2008). More recent studies (fish collected from 2000 to 2002) found a significant decreasing trend in biliary fluorescent aromatic compounds and significantly decreased lesions risk in English sole. Myers et al (2008) further indicate that "these results show that the sediment capping process has been effective in reducing PAH exposure and associated deleterious biological effects in resident flatfish..."

Most recent East Beach sediment PAH concentrations had exceedances of ecological criteria (concentrations above the SMS values) at two surface stations, and sheens and odors were observed in several of the 2011 clam collection locations. Therefore, PAHs are present in locations where epibenthic and benthic species are exposed to PAHs at levels greater than ROD-established criteria. Most recent North Shoal sediment PAH concentrations had exceedances of ecological criteria (concentrations above the SMS values) at two surface stations. During the 2011 clam collections, free product was observed in several of the sample holes at the North Shoal stations. Sheen was observed in the clam holes nearest the North Shoal area. Therefore epibenthic and benthic species are exposed to PAHs at the North Shoal. Clam tissue analysis indicated that epibenthic and benthic species at the Intertidal Cap stations are exposed to PAHs; however, sediment analysis indicated that sediments collected in this location did not exceed the SQS values. The clam tissue analysis indicates that an exposure route still exists for PAHs to be biologically available for epibenthic and benthic species at the North Shoal, and East Beach areas.

Surface sediment analysis for the EBS stations did not exceed the SQS values. No clams were collected in this area as none were found during the clam reconnaissance surveys. During that survey, essentially no epibenthic species were found in the holes dug looking for clams. Shallow sediments collected also did not indicate the presence of epibenthic species. The forage fish survey found limited forage fish eggs in the EBS at discrete locations during the two dates surveyed, perhaps suggesting that the EBS habitat is under utilized for forage fish spawning. No species of macroalgae or eelgrass were observed in the three EBS quadrants, and invertebrate life was not observed in the low or mid intertidal sample locations (HDR 2012).

East Harbor OU still has PAHs above SQS and exceedences of lower apparent effects threshold (LAET) values in the epibenthic and benthic zones. Since qualitative surveys of intertidal epibenthic and benthic species have not been collected over numerous years, no time-trend analysis of species diversity and density can be made for the East Harbor OU. This could be

useful for determining the rate of natural recovery for the East Beach component of the East Harbor OU. Contamination is still present in the sediments, and exposure routes to epibenthic and benthic species still exist. To determine if natural recovery is occurring, a survey of epibenthic species density and diversity along a series of transects would provide a time-trend base to support a recovery determination in addition to comparison to SQS. Compliance with SQS is determined at a few point locations while transect surveys would provide information of habitat utilization throughout the intertidal beach elevations. For example, during the clam surveys conducted at the North Shoal, NAPL was observed in the collection holes but the area is characterized as achieving SQS for this section of the East Harbor OU.

The vegetation plantings along the West Beach (EBS) were observed during a field visit on 14 Feb 2012. Some of the original plants from the 2002 West Beach mitigation died while the majority of the deciduous trees survived. The plants are located several feet away from the intertidal beach and therefore, the transfer of organic material into the intertidal zone to supply nutrients for epibenthic and benthic species is reduced. No surveys of plant survival or terrestrial species usage have been conducted since 2004. This portion of the OU provides a habitat that could be enhanced to increase usage by terrestrial species.

7.3.3. Toxicity Assessment

EPA's Integrated Risk Information System (IRIS) has a program to update toxicity values used by the Agency in risk assessment when newer scientific information becomes available. In the past five years, there have been a number of changes to the toxicity values for certain contaminants of concern at the Site.

7.3.3.1. Soil and Groundwater OU

In the past five years, there have been a few changes to the toxicity values for certain contaminants of concern at the Site. Revisions to the toxicity values for 2,3,7,8-TCDD and PCP indicate a higher risk from exposure to these chemicals than previously considered. Table 9 compares the ROD-established values with the new toxicity values. Because the contaminated soil is currently fenced and inaccessible to the public and the groundwater is not being used as drinking water, the changes to toxicity values do not affect the protectiveness of the remedy.

Table 9. Soil and Groundwater OU Changes in Toxicity

Chemical of Concern	Toxicity Factor ROD[1]	Change in Toxicity

Chemical of Concern	Toxicity Factor ROD[1]	Change in Toxicity
Pentachlorophenol (PCP)	Oral RfD: 0.03/mg/kg/day	Changed in 2010 Chronic RfD: 0.005 mg/kg-day Oral SF: 4E-1/mg/kg-day Drinking Water Unit Risk: 1E-5/µg/L
2,3,7,8-TCDD/TEF	1994 HEAST values used Slope factor: 1.5E+5 mg/kg/day	Changed in 2012 RfD: 7E-10 mg/kg-day

1 –Oral reference dose units for some compounds in original document were incorrectly identified as $(mg/kg\text{-}day)^{-1}$ instead of mg/kg-day.
HEAST – Health effects assessment summary table
Rfd – reference dose
SF – slope factor

7.3.3.2. West Harbor OU

In the past five years, there have been changes to the toxicity values for certain contaminants of concern at the Site. Revisions to the toxicity of PCP indicate a higher non-cancer and a lower cancer risk from exposure to these chemicals than previously considered. Revisions to the toxicity values for thallium indicate a lower risk from exposure to these chemicals than previously considered. Table 10 compares the ROD-established values with the new toxicity values. Because contaminated sediments are capped and health advisories are in place, these changes do not affect the protectiveness of the remedy.

Table 10. West Harbor OU Changes in Toxicity

Chemical of Concern	Toxicity Factor ROD[1]	Change in Toxicity
Pentachlorophenol (PCP)	Oral SF: 0.2 /mg/kg-day Oral RfD: 0.03/mg/kg-day	Changed in 2010 Chronic RfD: 0.005 mg/kg-day Oral SF: 4E-1/mg/kg-day Drinking Water Unit Risk: 1E-5/µg/L
Thallium (in soluble salts)	Oral RfD: 7E-5/mg/kg-day	Changed in 2009 Oral RfD: 1E-5 mg/kg-day

1 –Oral reference dose units for some compounds in original document were incorrectly identified as $(mg/kg\text{-}day)^{-1}$ instead of mg/kg-day.
Rfd – reference dose
UR – unit risk
SF – slope factor

7.3.3.3. East Harbor OU

In the past five years, there have been changes to the toxicity values for certain contaminants of concern at the Site. Revisions to the toxicity values for thallium indicate a lower risk from exposure to these chemicals than previously considered. The East Harbor OU ROD had the same contaminants of concern as the West Harbor OU. Therefore changes to toxicity for the East Harbor OU are the same as for the West Harbor. These changes do not affect the protectiveness of the remedy.

7.3.4. ARARs

Section 121 (d)(2)(A) of CERCLA specifies that Superfund remedial actions must meet any federal standards, requirements, criteria, or limitations that are determined to be Applicable or Relevant and Appropriate Requirements (ARARs). Applicable or Relevant and Appropriate Requirements are those standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

7.3.4.1. Soils and Groundwater OU

Since the ROD, the majority of the ARARs have remained unchanged. Appendix I present an evaluation of ARARs for this Soils and Groundwater OU and include a summary of changes in chemical-specific ARARs. Changes in ARARs do not affect the protectiveness of the remedy.

7.3.4.2. West Harbor OU

Since the ROD, the majority of the ARARs have remained unchanged. Appendix I present an evaluation of ARARs for West Harbor OU. Changes in ARARs do not affect the protectiveness of the remedy.

7.3.4.3. East Harbor OU

Since the ROD, the majority of the ARARs have remained unchanged. Appendix I present an evaluation of ARARs for East Harbor OU. Changes in ARARs do not affect the protectiveness of the remedy.

7.3.5. Progress Towards Meeting RAOs

7.3.5.1. Soils and Groundwater OU

The remedial action objectives for the soil are currently being met. Fencing and site health and safety measures prevent human exposure through direct contact with contaminated soil within the Former Process Area. The sheet-pile wall prevents storm water runoff containing contaminated soil from reaching Eagle Harbor. The soil cap described in the ROD would be required prior to public use of the Former Process area.

Achieving the groundwater remedial objectives is still in progress. The pilot study which included some groundwater extraction removed some NAPL along with dissolved-phase contamination, but NAPL still remains in the sub-surface. EPA is currently conducting a focused feasibility study to further evaluate NAPL source removal. No one is currently using the groundwater as a drinking water source.

7.3.5.2. West Harbor OU

The remedial objectives for this operable unit have been met. The goal of achieving MCUL in sediments has been met through the hot spot removal, intertidal barrier and CDF construction.

7.3.5.3. East Harbor OU

In general the remedial objectives for human health protection and achievement the SMS/MCUL are being met. In some areas of the subtidal cap where material thickness is less than the target remedial goals (within the ferry navigation lane) and on two locations each on North Shoal and East Beach, these objectives are not currently being met. There is also concern that cap material is not present in the vicinity of J9, though currently this area meets the SMS. The long-term goal of reducing contaminants in fish and shellfish to levels protective of human health and the environment is in progress. Current clam tissue sampling results cannot be compared to previous clam tissue sampling due to differences in reporting limits. Additional tissue sampling should be considered to establish a time-trend analysis for PAHs.

The remedial action objectives for the EBS as described in the 2007 ESD have been met.

7.4. Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

7.4.1. Soils and Groundwater OU

No additional information has come to light that could call into question the protectiveness of the remedy.

7.4.2. West Harbor OU

No additional information has come to light that could call into question the protectiveness of the remedy.

7.4.3. East Harbor OU

No additional information has come to light that could call into question the protectiveness of the remedy.

7.5. Technical Assessment Summary

Overall, the Soil and Groundwater OU containment remedy is currently functioning as designed. The aging GWTP has been replaced. The new plant was completed in 2009 and went online in April 2010. Monitoring has generally demonstrated that the groundwater extraction system is providing hydraulic containment; however, there have been instances during periods of heavy precipitation where containment was not demonstrated. Recent monitoring in 2011 indicates that containment is currently being met. The sheet-pile wall is showing signs of corrosion in the splash zone. Corrosion protection for the sheet-pile wall and completing the cap to control infiltration at the site should be considered to ensure more consistent maintenance of hydraulic control. Some toxicity values identified in the ROD have been revised. However these revisions do not affect the protectiveness of the remedy. Exposure pathways identified in the ROD have not changed.

The West Harbor OU remedy is currently functioning as designed. The asphalt cap, BMPs, CDF, and tidal barrier performance are being monitored. Performance standards are currently being met and are documented in the quarterly and annual monitoring reports. Institutional controls are in place to control contact with contaminated soils and consumption of marine organisms in Eagle Harbor. Some toxicity values identified in the ROD have been revised. However these revisions do not affect the protectiveness of the remedy. Exposure pathways identified in the ROD have not changed.

Overall, the East Harbor OU remedy is functioning as intended. The subtidal, intertidal, and EBS caps are monitored according to the OMMP to determine cap stability, effectiveness of contaminant isolation, natural recovery, and habitat use. Areas of the subtidal cap within the ferry navigation lane do not have cap material thickness that meets the target remedial goals and are then ineffective in isolating underlying contaminated sediments. The area of the subtidal cap within grid-cell J-9 does not meet target remedial goals. However, surface sediment sample results show no exceedances. The intertidal cap remains within target thickness, shows effective contaminant isolation of underlying contaminated sediments and provides habitat for a number

of species. The EBS may not have achieved physical stability particularly in the lower intertidal areas with potential losses in the lower intertidal areas and material gains in the upper intertidal zones. Material replacement will be required in the future to achieve physical stability. However, no exceedances in the cover material show that EBS is effectively isolating underlying contaminated sediment. Functional habitat is observed in the North Shoal and East Beach areas. North Shoal has met the 10 year natural recovery goals except at two stations. The East Beach has met the 10 year natural recovery goals except at tow surface stations. Institutional controls are in place to control contact with contaminated sediment and consumption of marine organisms in Eagle Harbor. Some toxicity values identified in the ROD have been revised. However these revisions do not affect the protectiveness of the remedy. Exposure pathways identified in the ROD have not changed.

8. ISSUES, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS

Table 11 summarizes the current issues for the Wyckoff/Eagle Harbor Superfund Site.

Table 11. Summary of Issues

Issues	Follow-Up Actions: Affects Protectiveness (Y/N)	
	Current	Future
1. Soils and Groundwater OU. Hydraulic containment may not be demonstrated during the wet season or periods of heavy precipitation.	N	Y
2. Soils and Groundwater OU. No soil cap has been constructed on the Former Process Area.	N	Y
3. Soils and Groundwater OU. Access controls (fencing and on-site personnel) are currently in place, however long-term Institutional controls have not been established to prevent potential future exposure to contaminated soils in the Former Process Area.	N	Y
4. Soils and Groundwater OU. The groundwater quality monitoring program is inconsistent.	N	Y
5. Soils and Groundwater OU. Corrosion of the outer sheet pile wall is occurring from salt water and oxygen exposure.	N	Y
6. East Harbor OU. Cap material thickness in the subtidal cap within the ferry navigation zone is less than the target remedial goal. This lessens the effectiveness of the cap to isolate underlying contaminated sediments in the short term.	N	Y
7. East Harbor OU. Cap material thickness in the subtidal cap within grid cell J-9 is less than the target remedial goal. The surface sediment concentrations currently meet remedial goals. Future effectiveness of the cap at to isolate underlying contaminants at this location could be lessened.	N	Y
8. East Harbor OU. Two surface sediment sample locations at the East Beach and North Shoal have not met the natural recovery goal. Subsurface sediments still contain substantive residual hydrocarbons.	N	Y
9. East Harbor OU. Clam tissue sampling at Intertidal Beach, North Shoal and East Beach show elevated levels of contaminants which are still above risk-based levels.	N	Y

Table 12 provides recommendations to address the current issues at the Wyckoff/Eagle Harbor Superfund Site, along with proposed milestone dates to achieve the recommended follow-up actions.

Table 12. Summary of Recommendations and Follow-up Actions

Recommendations/Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-Up Actions: Affects Protectiveness (Y/N)	
				Current	Future
1. Soils and Groundwater OU. Optimize the operation of the extraction system to ensure hydraulic containment is met during all seasons.	Ecology	EPA	July 2013	N	Y
2. Soils and Groundwater OU. Construct a soil cap per the ROD. The soil cap should be constructed of impermeable material to reduce infiltration to the shallow aquifer.	EPA	EPA	September 2020	N	Y
3. Soils and Groundwater OU. Establish institutional controls after the construction of the soil cap to allow for maximum use.	EPA	EPA	December 2020	N	Y
4. Soils and Groundwater OU. Implement a groundwater quality monitoring program with regularly scheduled sampling events to obtain a comprehensive assessment of hydraulic containment and long term concentration trends.	EPA	Ecology	September 2013	N	Y
5. Soils and Groundwater OU. Evaluate extent of corrosion and install corrosion protection for the outer sheet pile wall.	EPA	Ecology	April 2016	N	Y
6. East Harbor OU. Evaluate, design, and construct subtidal cap material	EPA	Ecology	December 2014	N	Y

Recommendations/Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-Up Actions: Affects Protectiveness (Y/N)	
				Current	Future
replacement in ferry lane to meet the target remedial goal.					
7. East Harbor OU. Construct subtidal cap in grid cell J-9 per original design to meet target remedial goal.	EPA	EPA	April 2016	N	Y
8. East Harbor OU. Continue to monitor the East Beach and North Shoal for natural recovery and evaluate the necessity of an additional remedial action to mitigate residual contamination.	EPA	EPA	April 2016	N	Y
9. East Harbor OU. Continue to monitor clam tissue to establish time-trends and continue shellfish restrictions.	EPA	EPA	September 2013	N	Y

Included below are additional recommendations to be considered that do not affect current or future protectiveness of the remedy:

- Implement a regular monitoring frequency as part of the OMMP at the East Harbor OU.
- Provide additional signs along the North Shoal and East Beach that are readable during low tides to alert the public of the contaminant hazards present.
- Enhance the upland portion of West Beach to improve terrestrial habitat.
- Continue physical monitoring of the EBS to determine if and where material loss is occurring and whether it is providing functional habitat to marine aquatic organisms such as forage fish.
- Continue regular repair of cracks in the Ferry Maintenance Yard (West Harbor OU) asphalt cap.

9. PROTECTIVENESS SUMMARY

The protectiveness statements for each operable unit are as follows:

9.1. Soil and Groundwater OU

The remedy is expected to be protective to human health and the environment when the soil cap is constructed and appropriate institutional controls are in place for the anticipated future land use (currently planned to be a park). Exposure pathways that could result in unacceptable risks are currently being controlled by the fencing, sheet-pile wall and groundwater treatment system and no one is currently using the groundwater as a drinking water source.

9.2. West Harbor OU

The remedy is considered protective to human health and the environment. Exposure pathways that could result in unacceptable risks are being controlled by the asphalt cap and intertidal barrier system.

9.3. East Harbor OU

The remedy is expected to be protective to human health and the environment after the replacement and extension of the subtidal cap in the areas of the ferry navigation lane and, if determined to be necessary, J9, and continued monitoring of East Beach and North Shoal show that natural recovery goals have been met.

10. NEXT REVIEW

This is a Site that according to the CERCLA statute, as amended, requires ongoing five-year reviews as long as contaminants remain on site that do not allow for unlimited use and unrestricted exposure. The next five-year review will be due within five years of the signature date of this five-year review (September 2017).

FIGURES

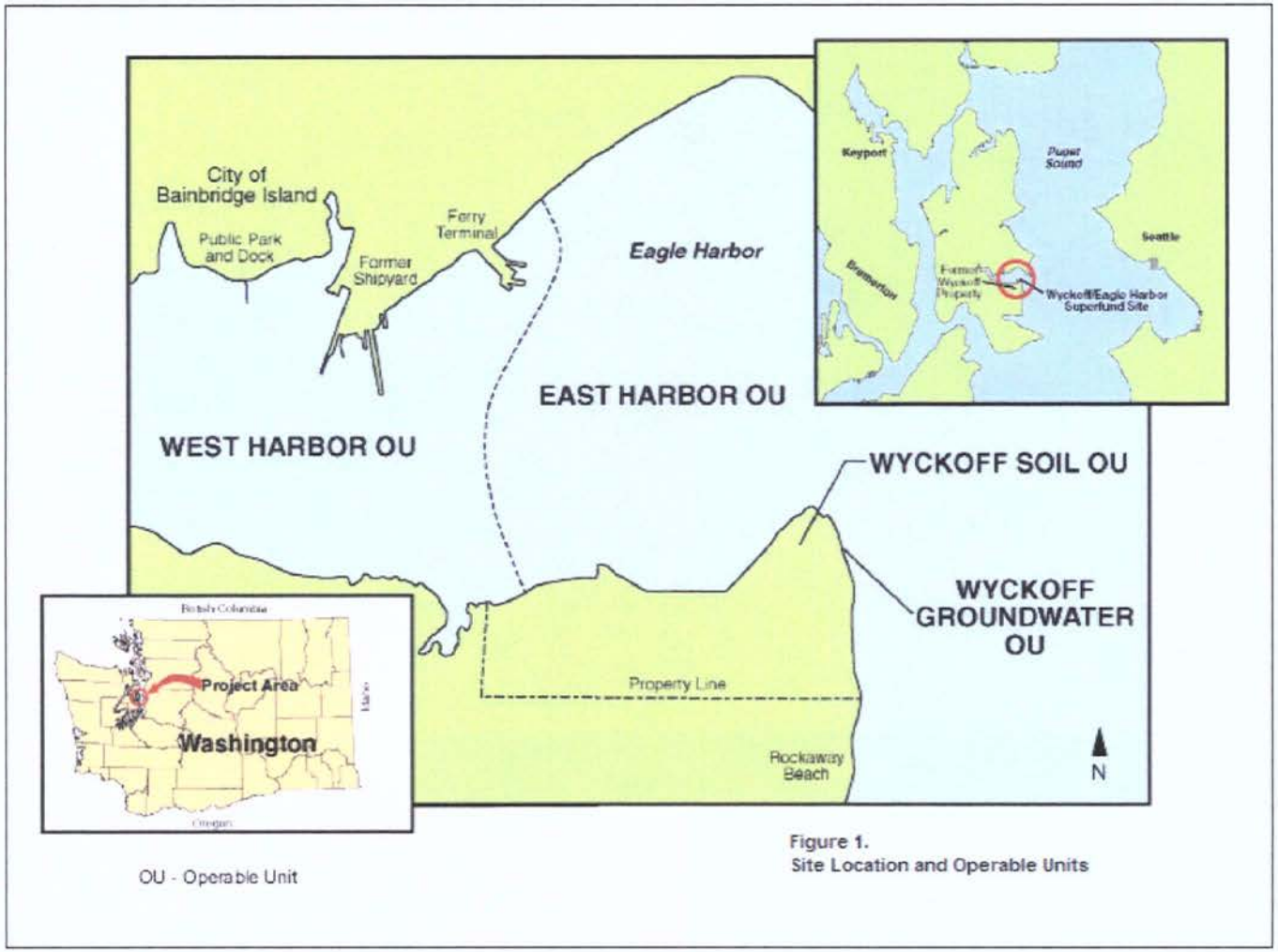


Figure 1. Site Location and OUs

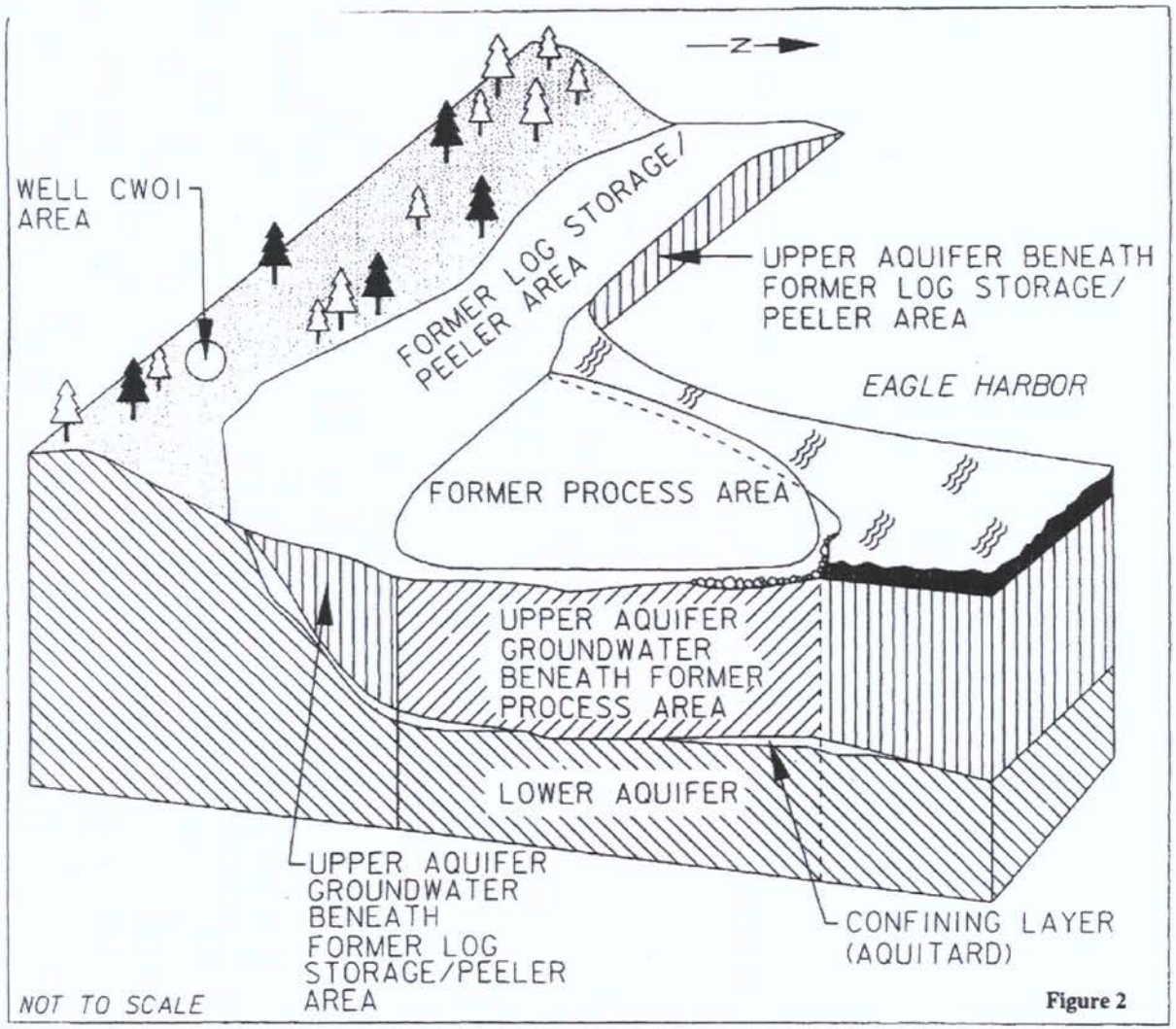


Figure 2. Soil and Groundwater OU Components

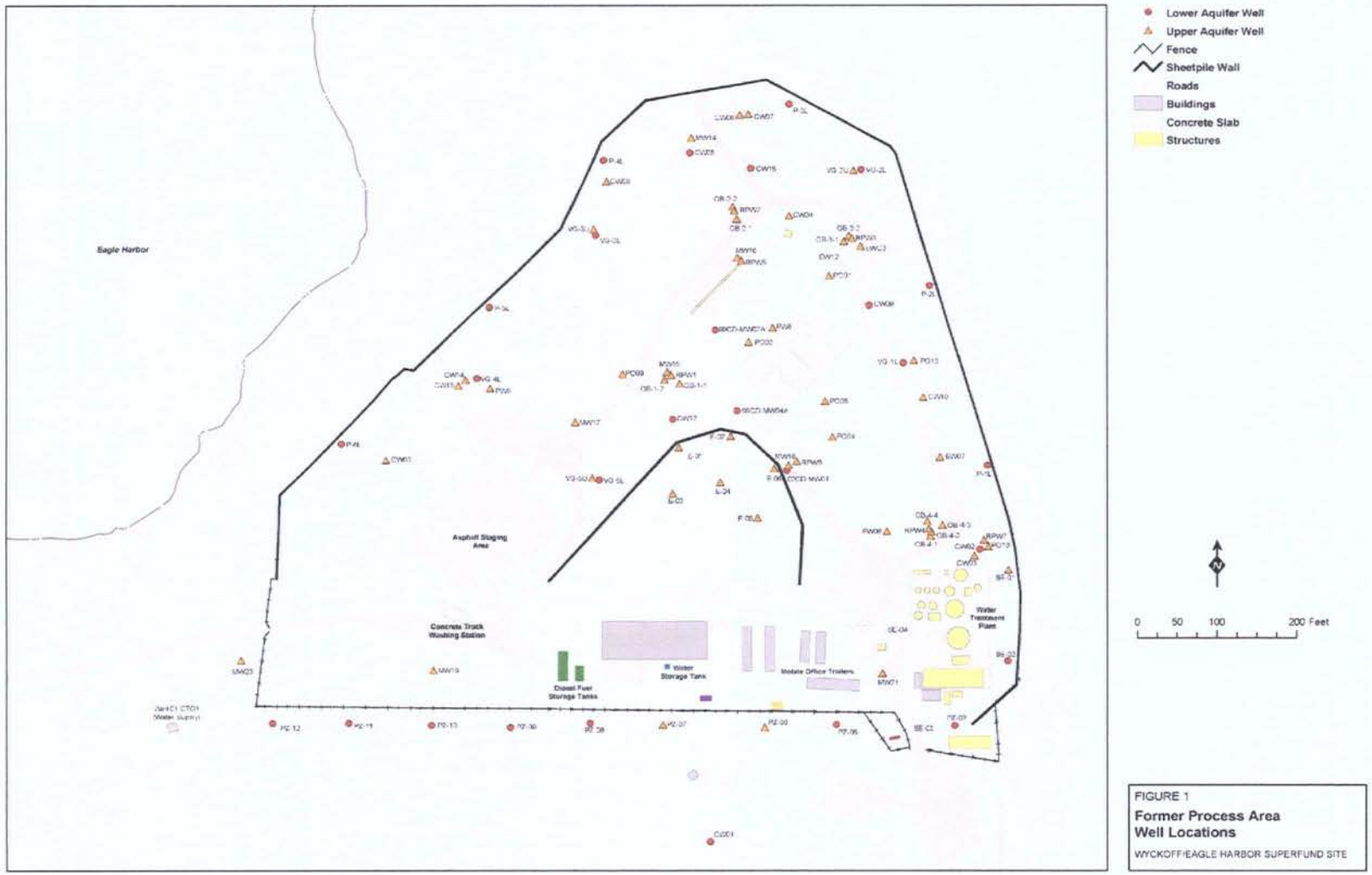


Figure3. Soil and Groundwater OU Site Features and Monitoring Well Locations

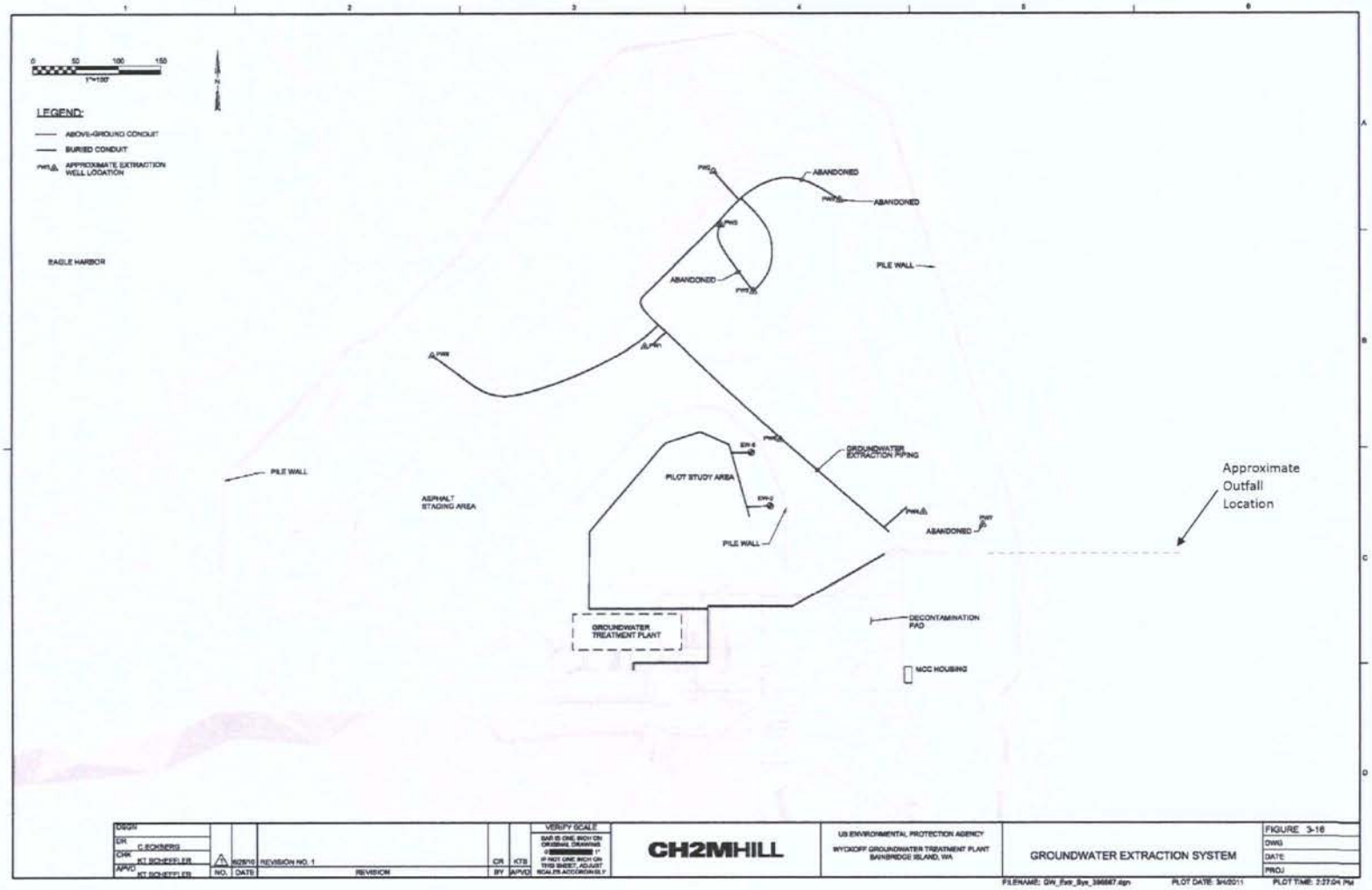


Figure 4. Soil and Groundwater OU New Treatment Plant and Extraction Well Locations

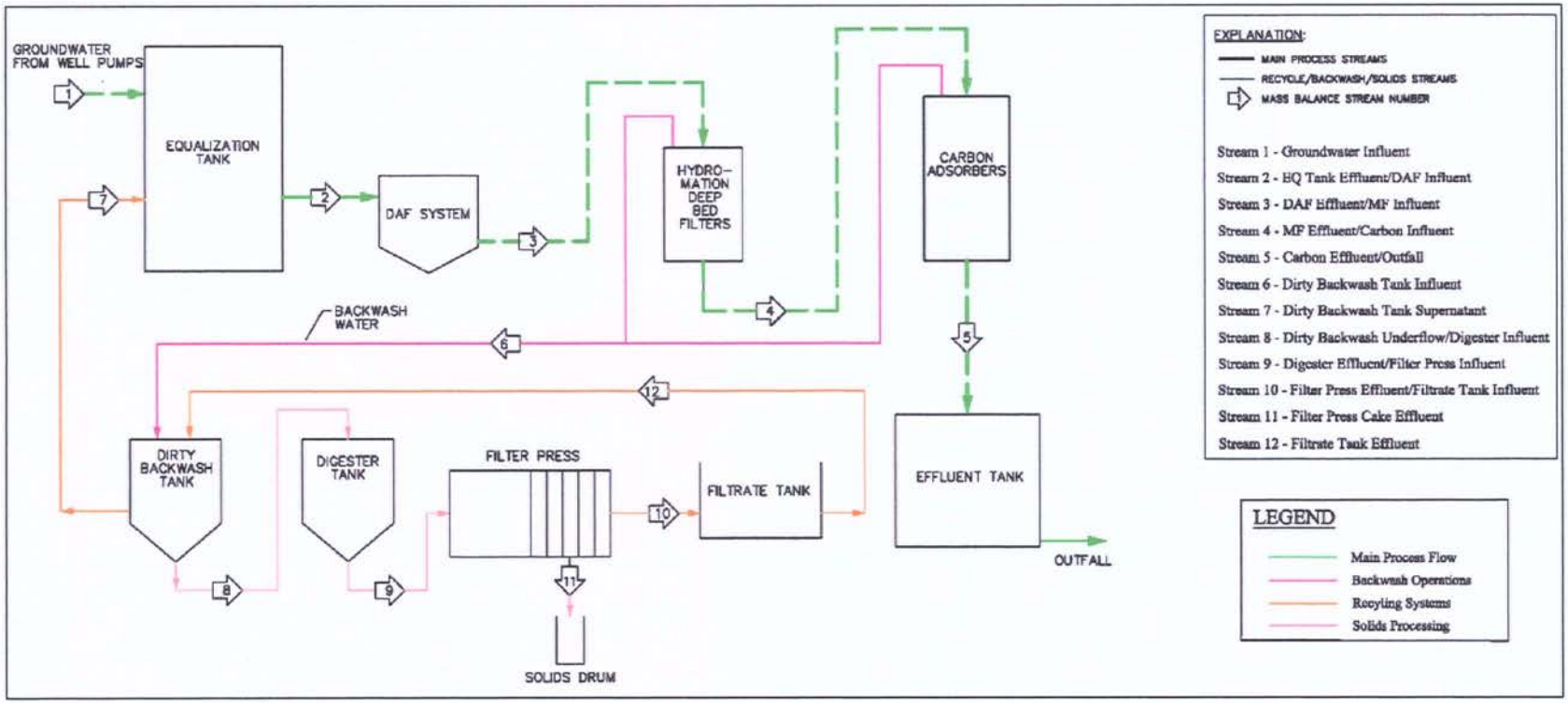


Figure 5. Soil and Groundwater OU Process Flow Diagram of New Groundwater Treatment Plant

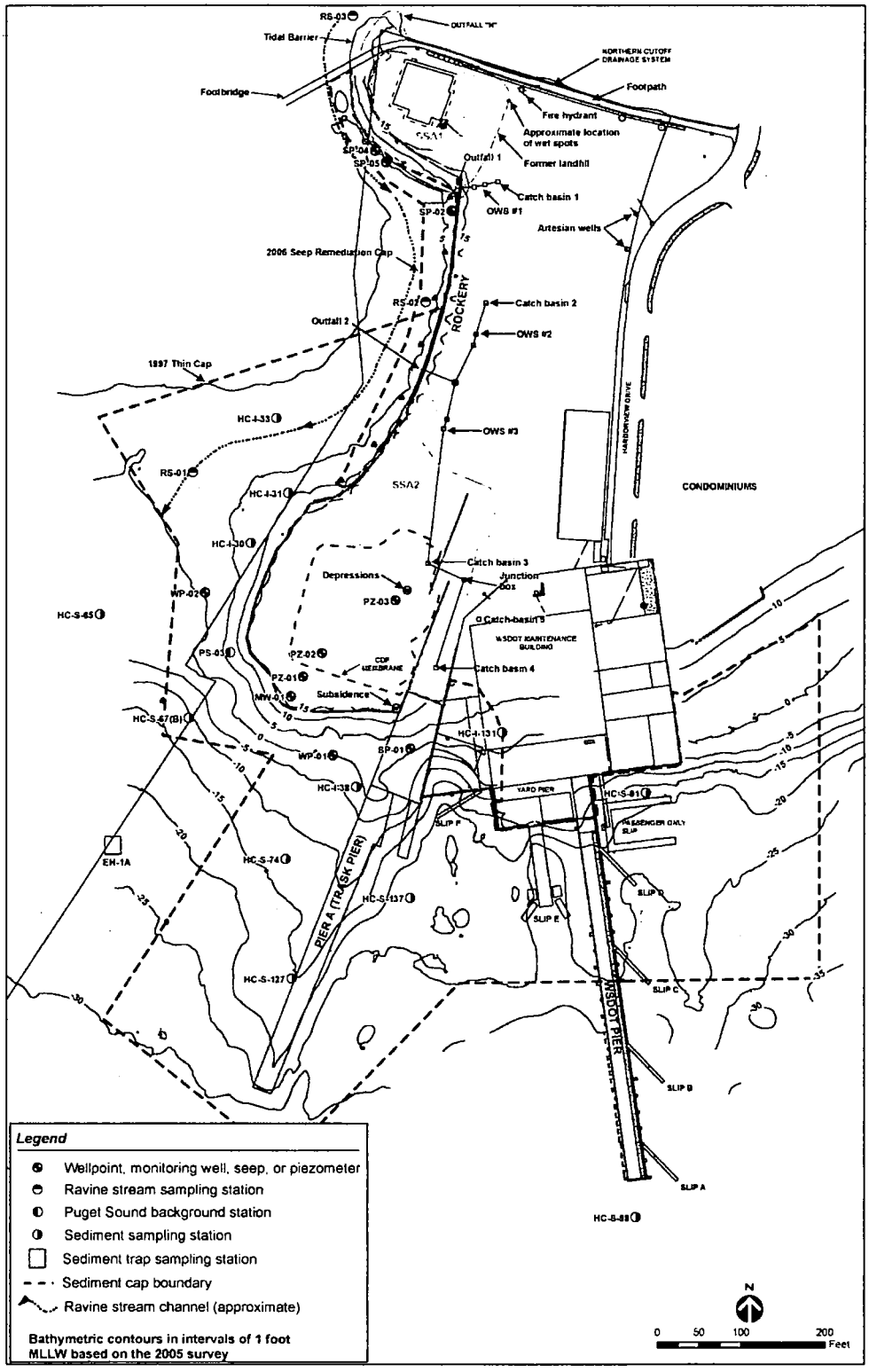


Figure 6. West Harbor OU Site Features and Monitoring Stations

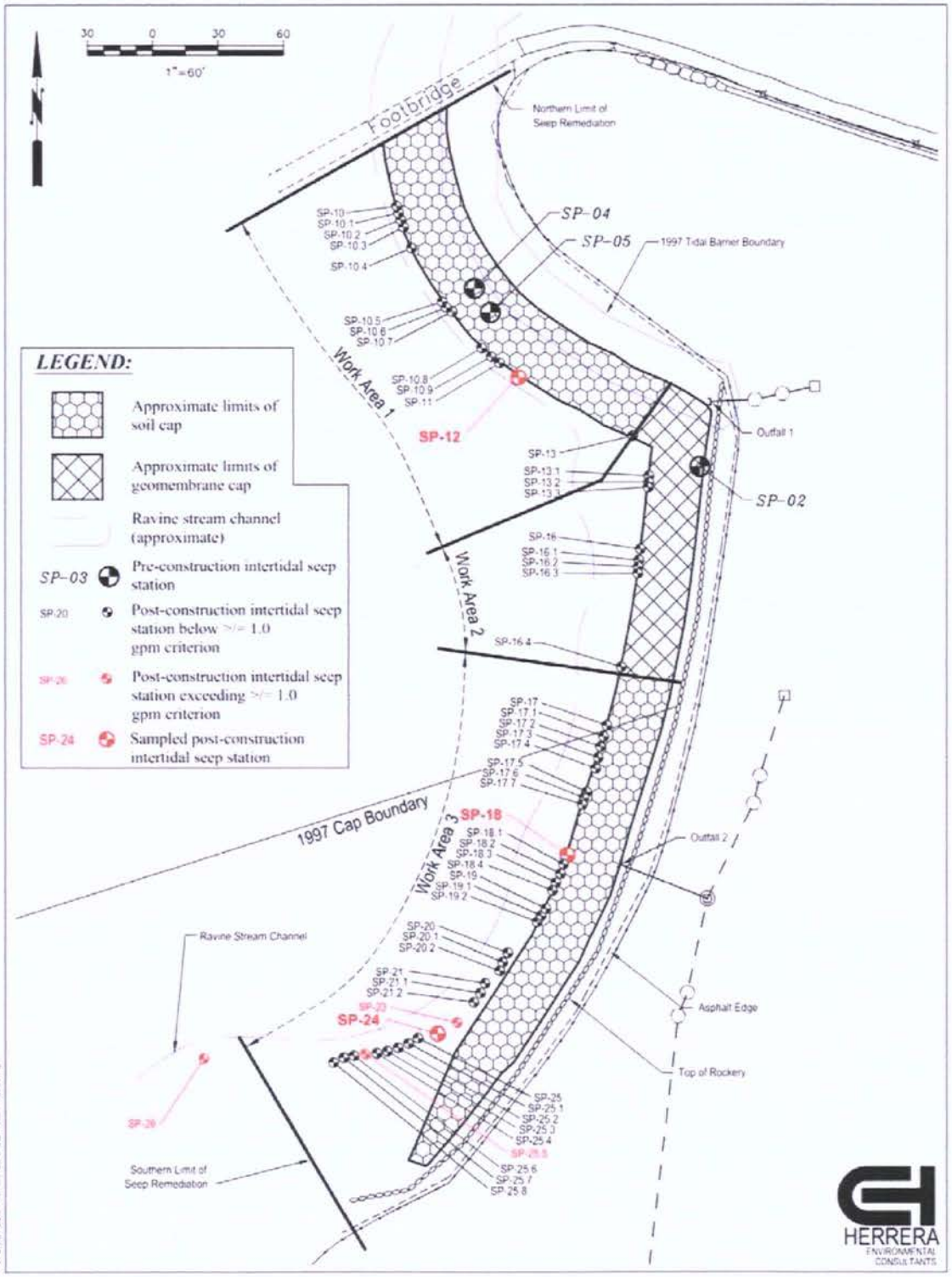


Figure 7. West Harbor OU Seep Monitoring Stations, May 2011

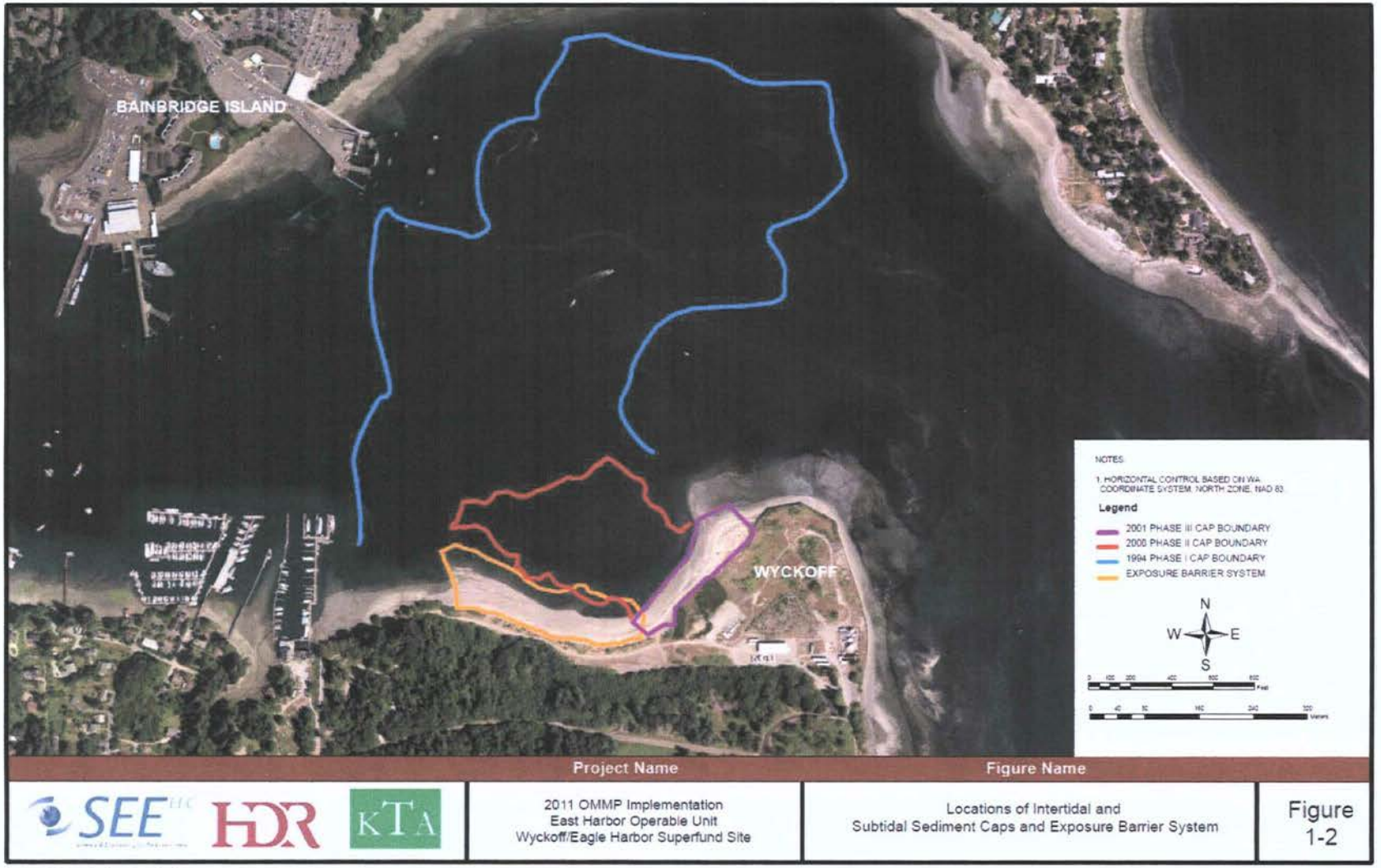


Figure 8. East Harbor OU Sediment Cap Locations

Figure 9. East Harbor OU Intertidal Designations

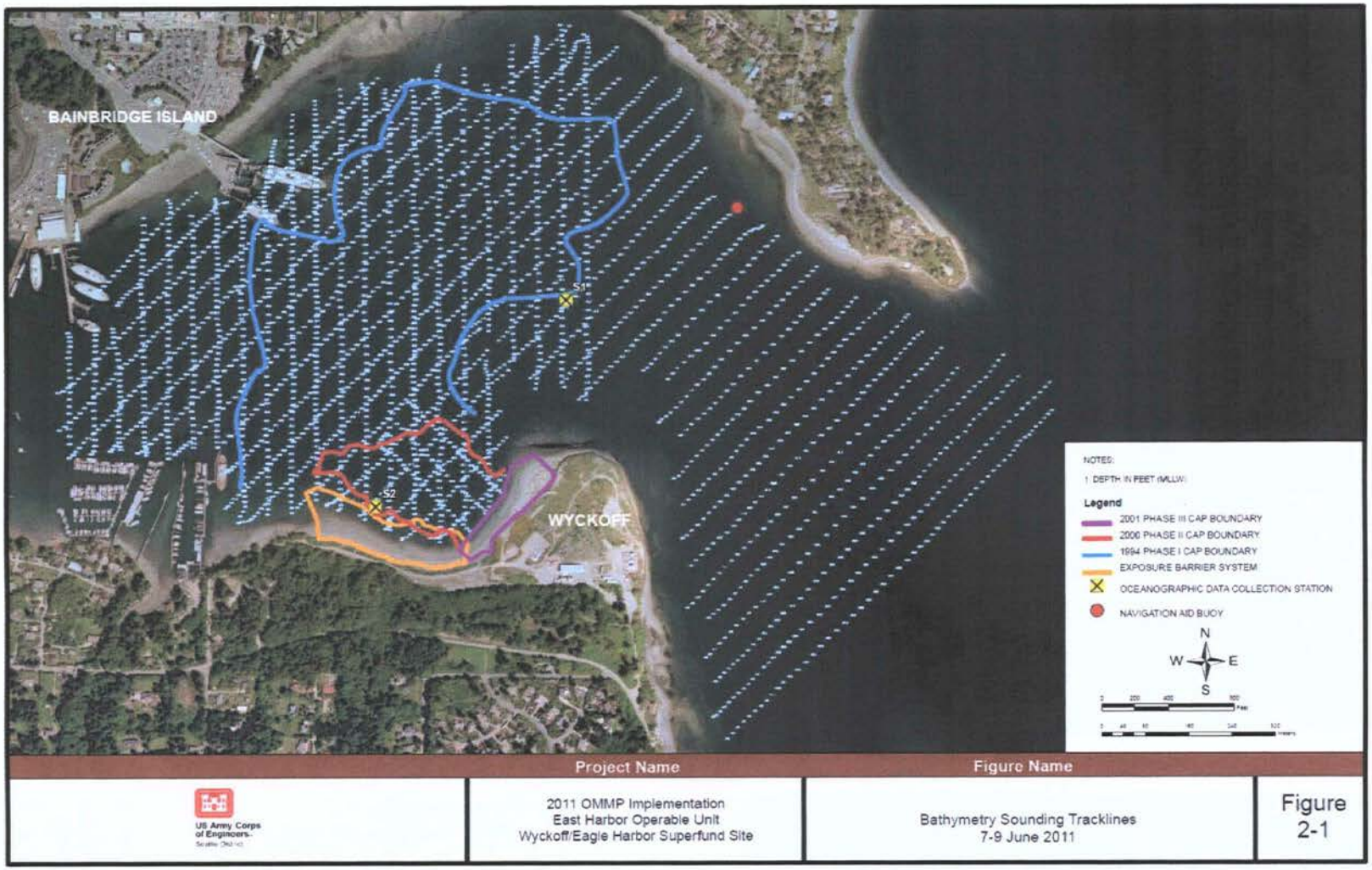


Figure 10. East Harbor OU Bathymetry Sounding Tracklines

Figure 11. East Harbor OU Photogrammetric Topographic Spot Elevations

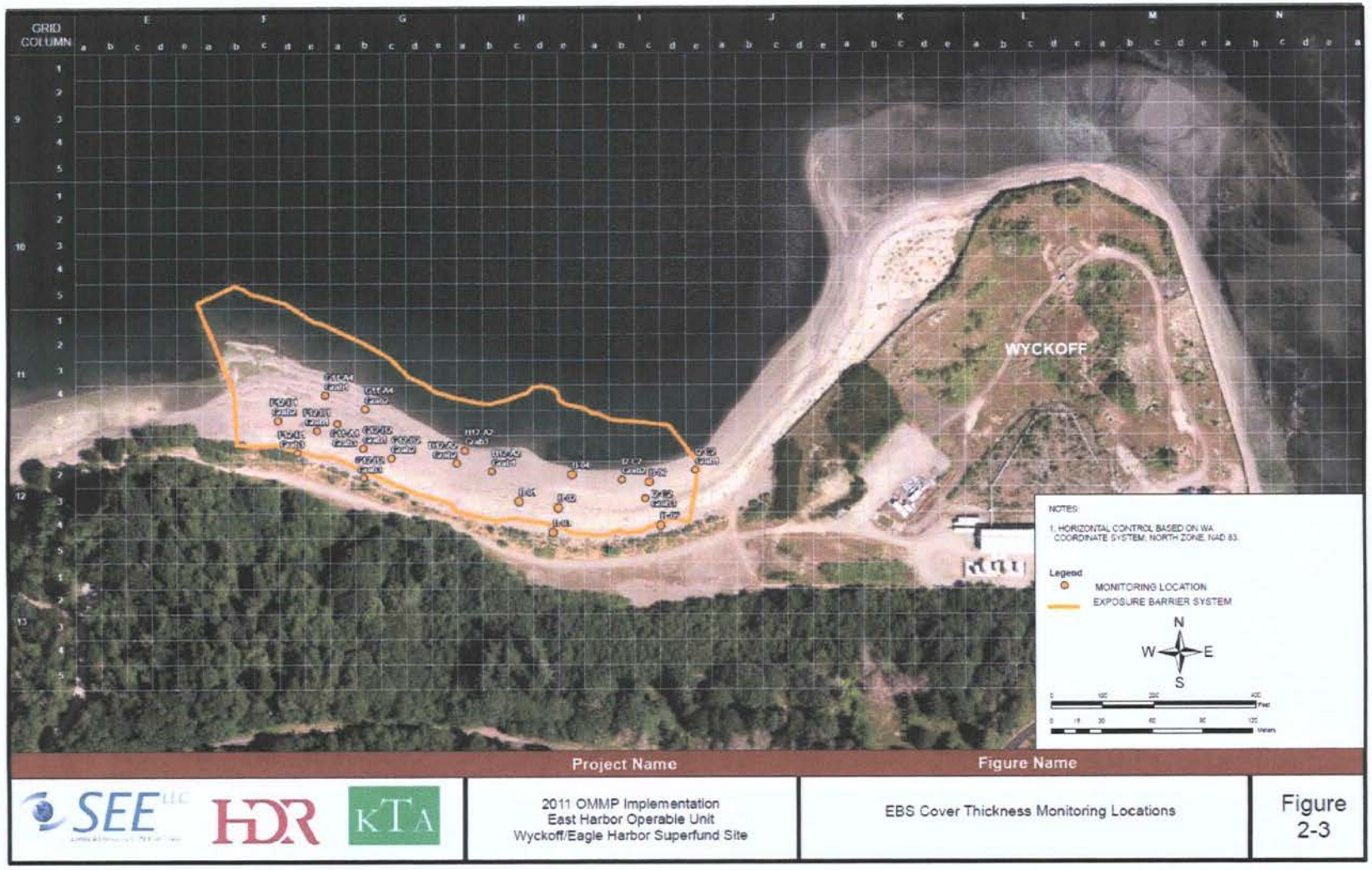


Figure 12. East Harbor OU EBS Cover Thickness Monitoring Locations

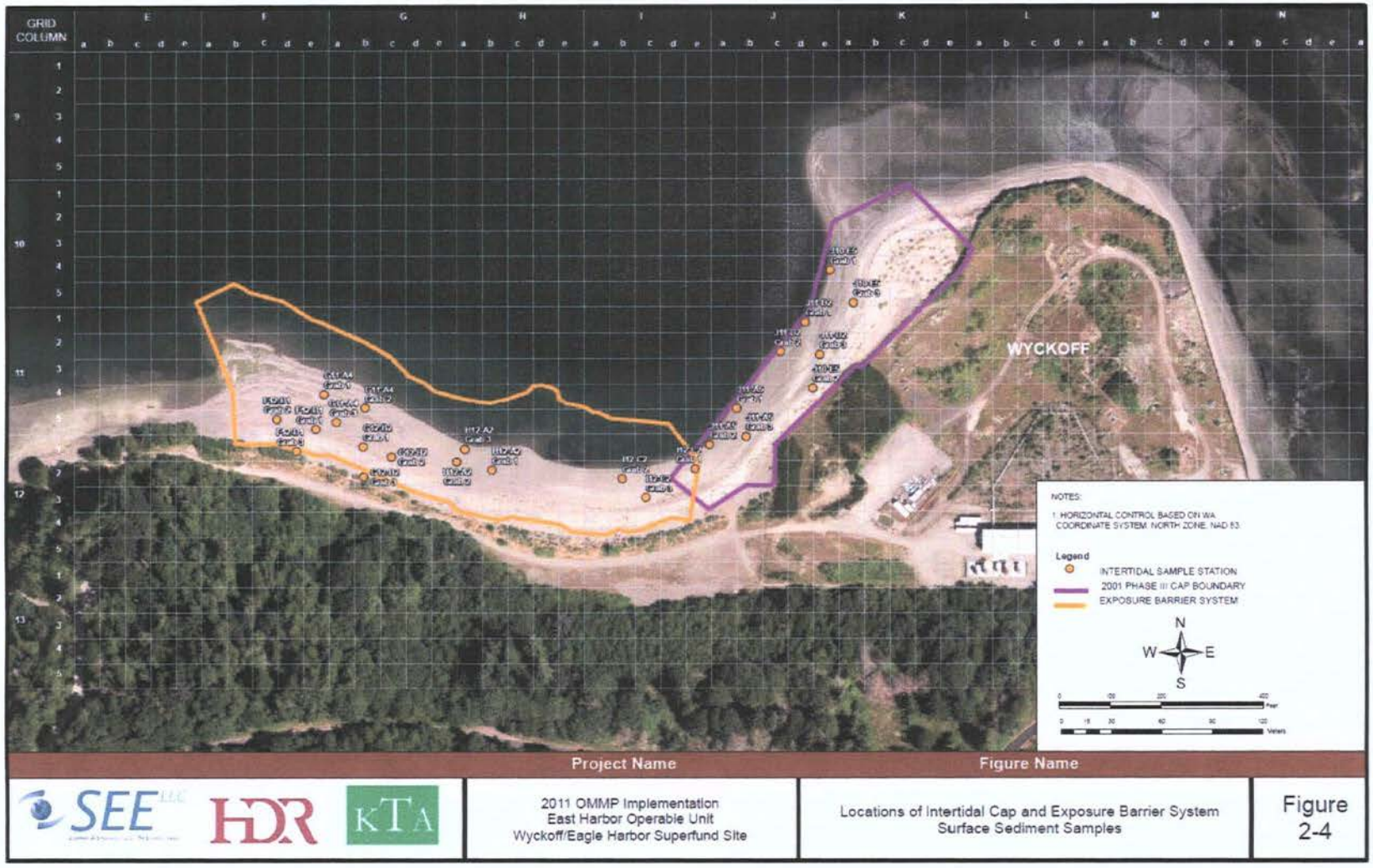


Figure 13. East Harbor OU Intertidal Cap and EBS Surface Sediment Sample Locations

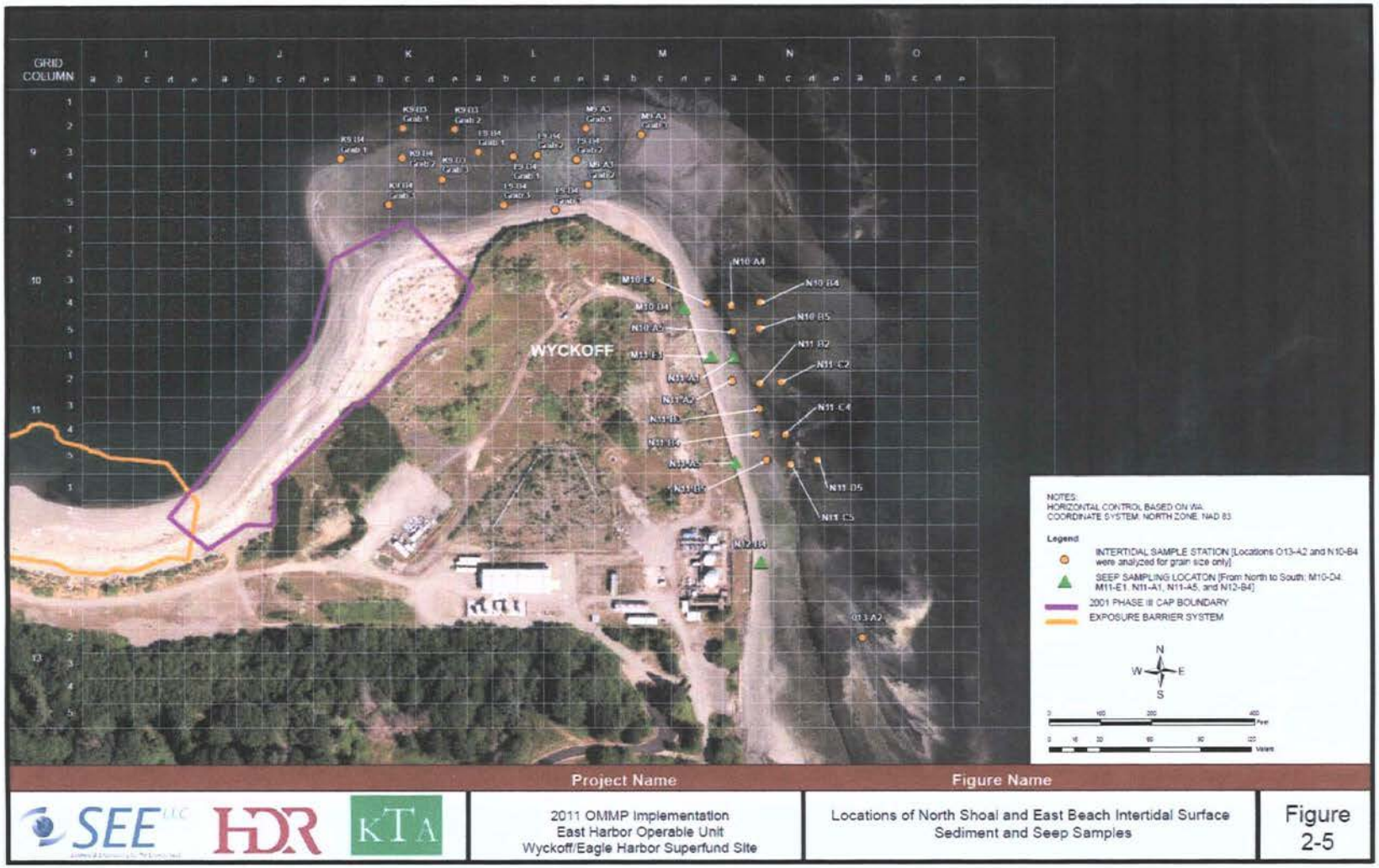


Figure 14. East Harbor OU North Shoal and East Beach Intertidal Surface Sediment and Seep Sample Locations

Figure 15. East Harbor OU East Beach Intertidal Subsurface Sediment Sample Locations

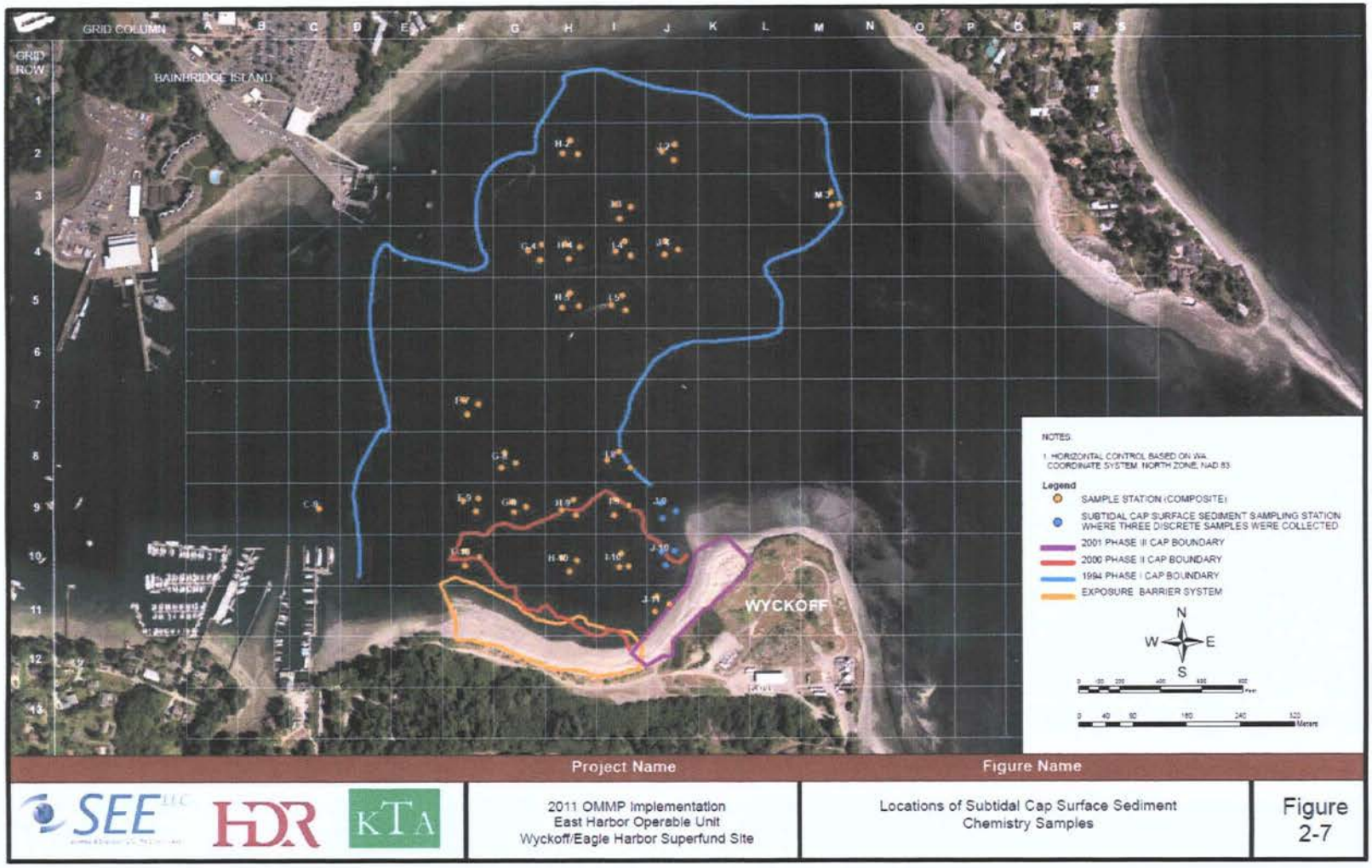


Figure 16. East Harbor OU Subtidal Cap Surface Sediment Chemistry Sample Locations

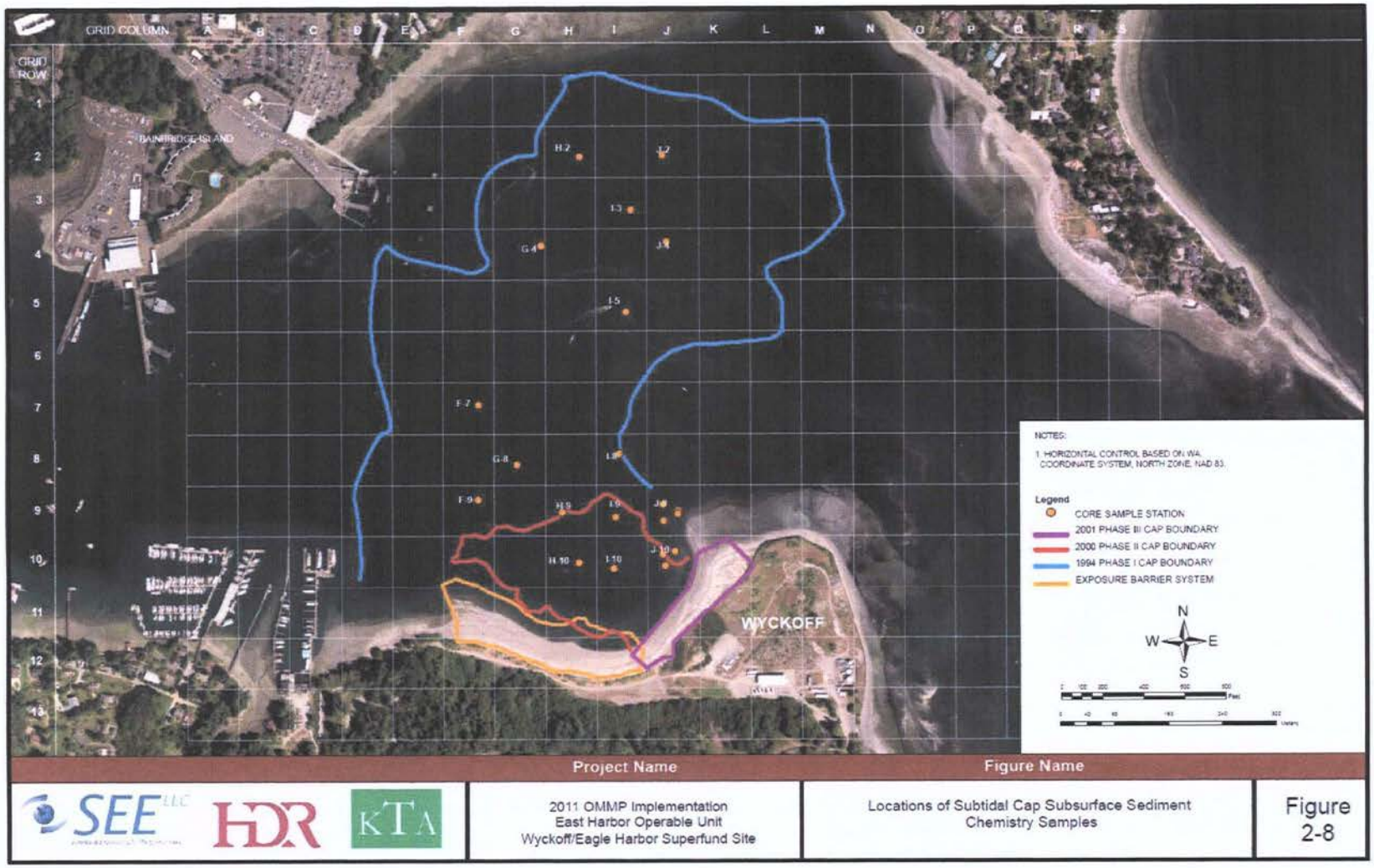


Figure 17. East Harbor OU Subtidal Cap Subsurface Sediment Chemistry Sample Locations

Figure 18. East Harbor OU Clam Survey Locations

Figure 19. East Harbor OU Bird and Mammal Visual Survey Locations

Figure 20. East Harbor OU Forage Fish Bulk Sampling Transects within EBS and Intertidal Cap

Figure 21. East Harbor OU Invertebrate and Macroalgae Sample Locations

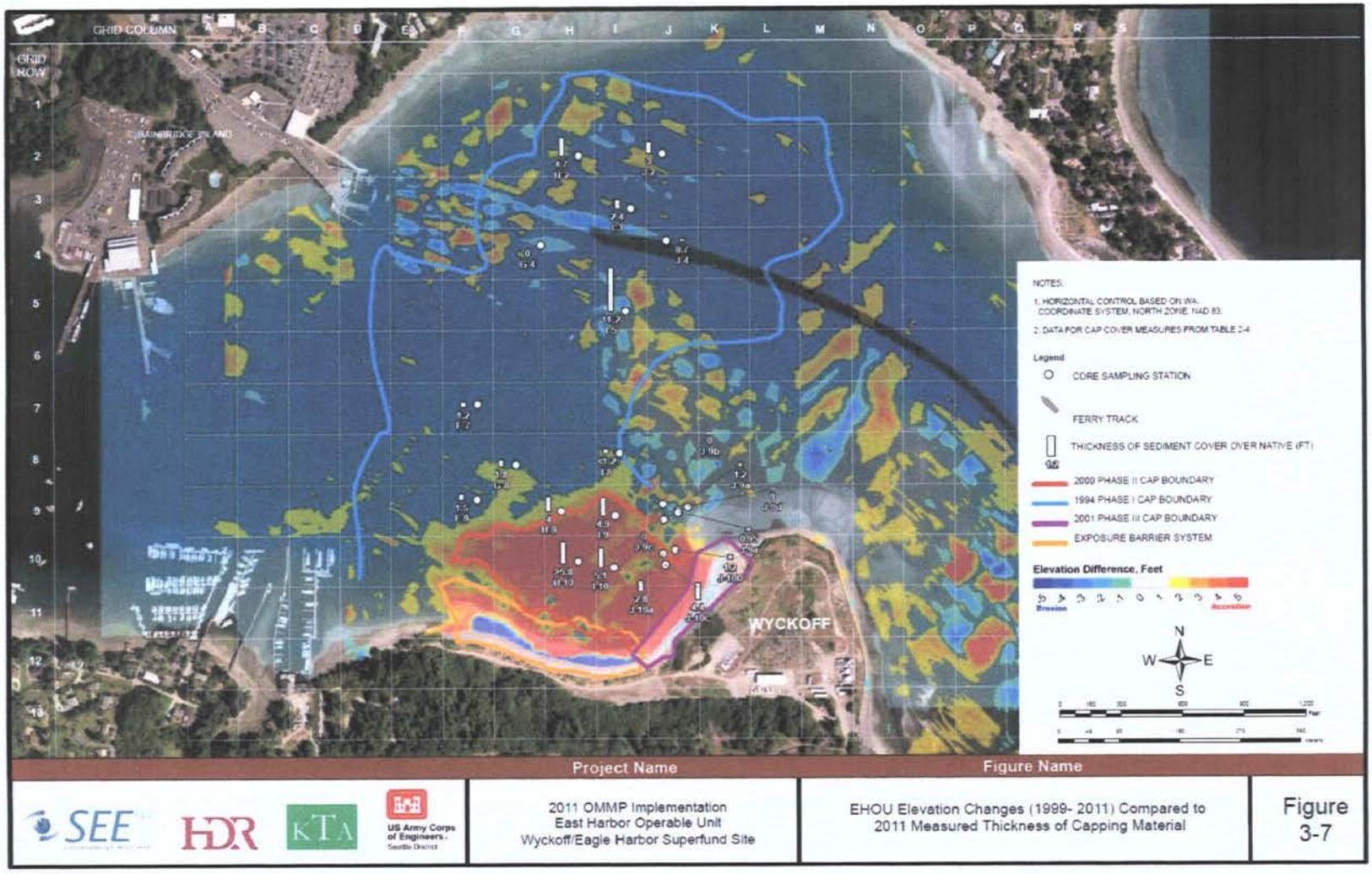


Figure 22. East Harbor OU Eagle Harbor Elevation Changes from 1999 to 2011

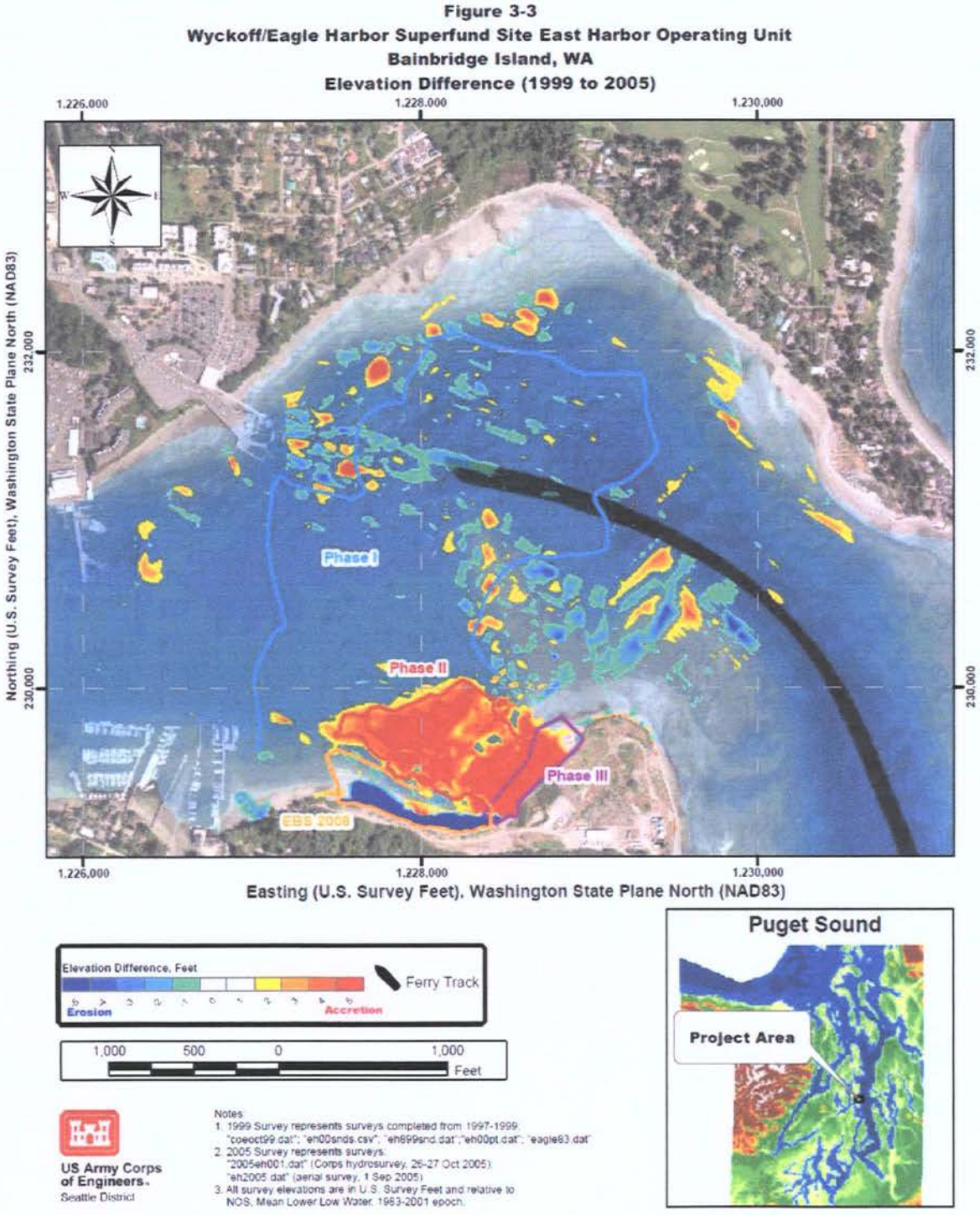


Figure 23. East Harbor OU Eagle Harbor Elevation Differences from 1999 to 2005

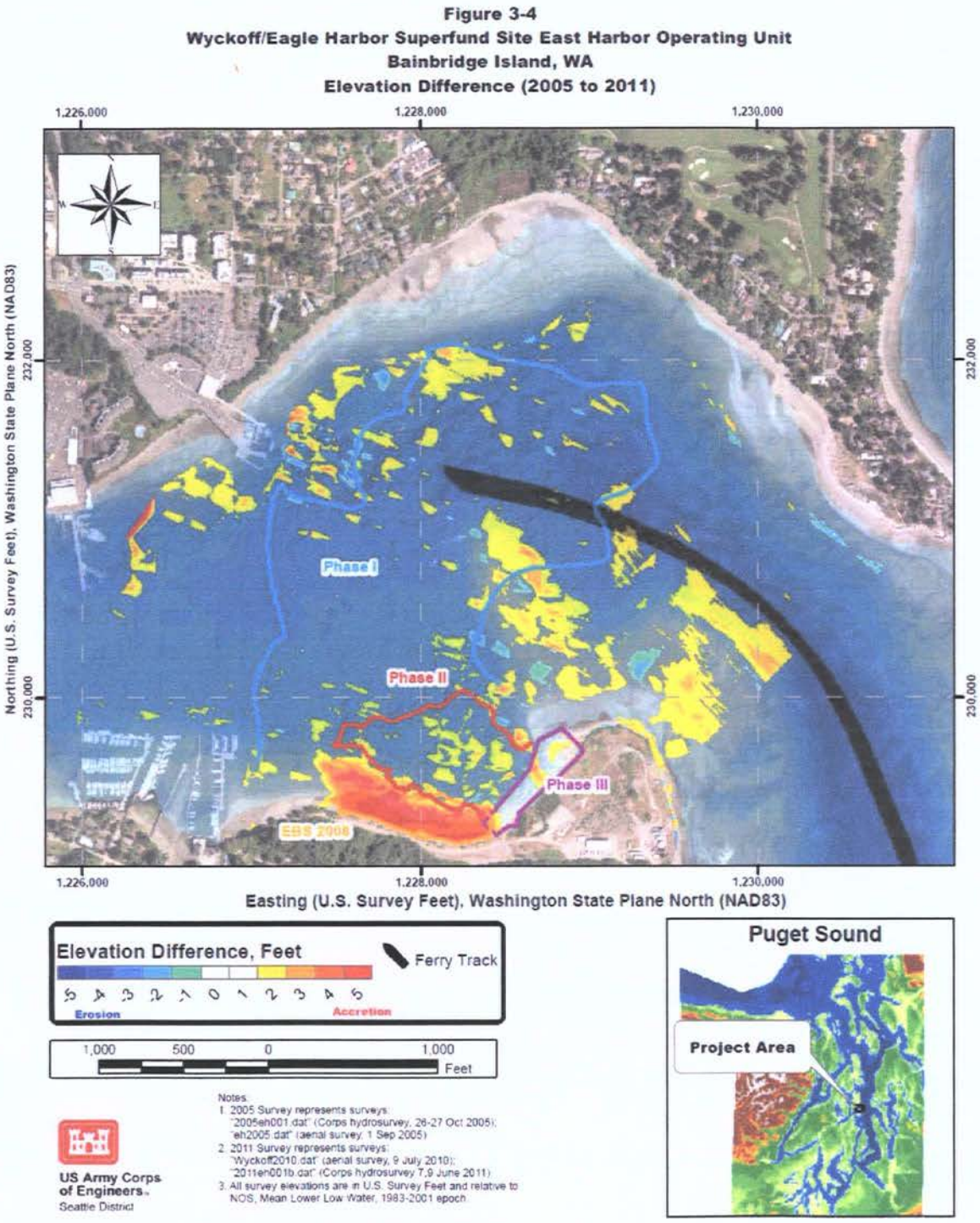


Figure 24. East Harbor OU Eagle Harbor Elevation Differences from 2005 to 2011

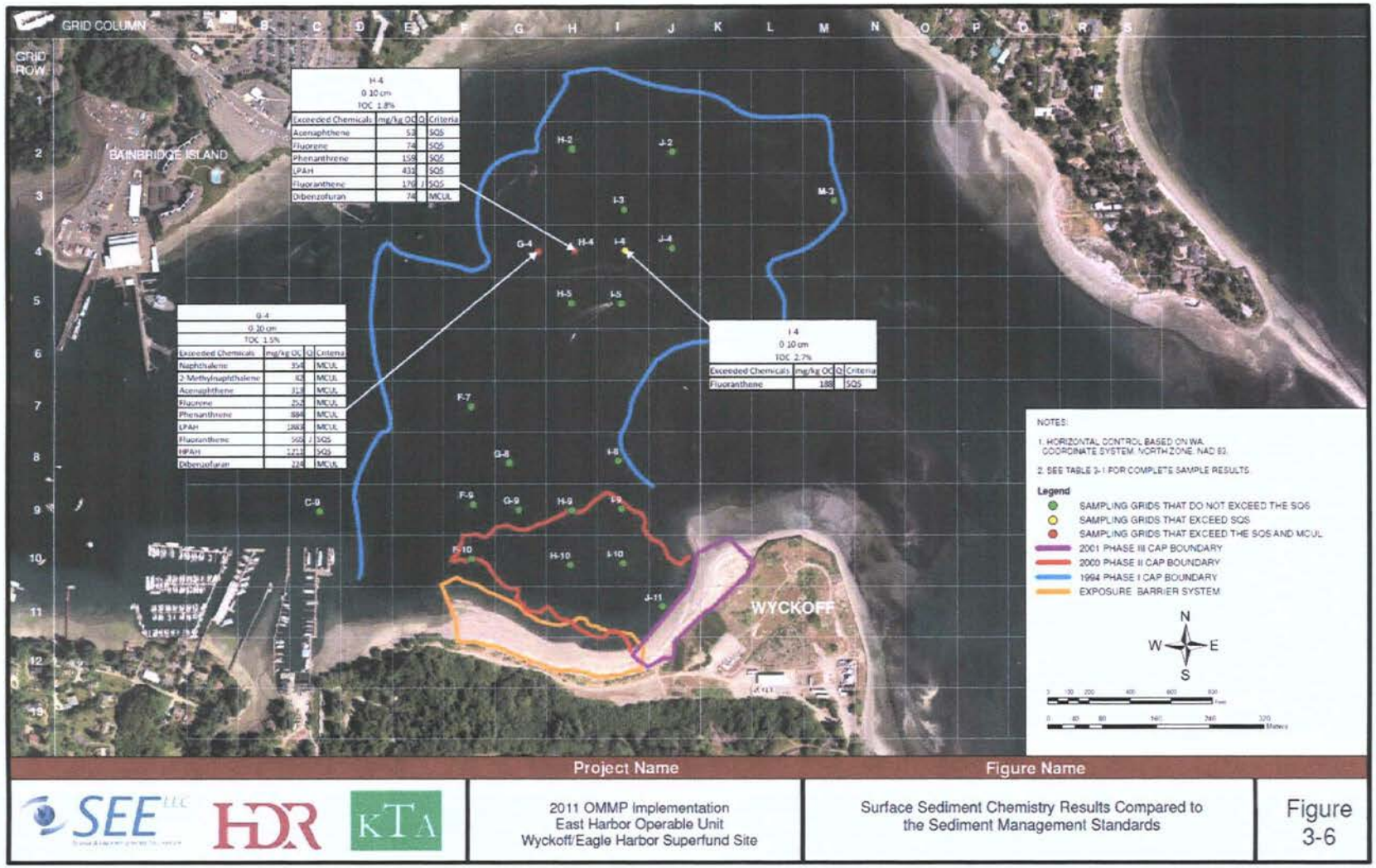
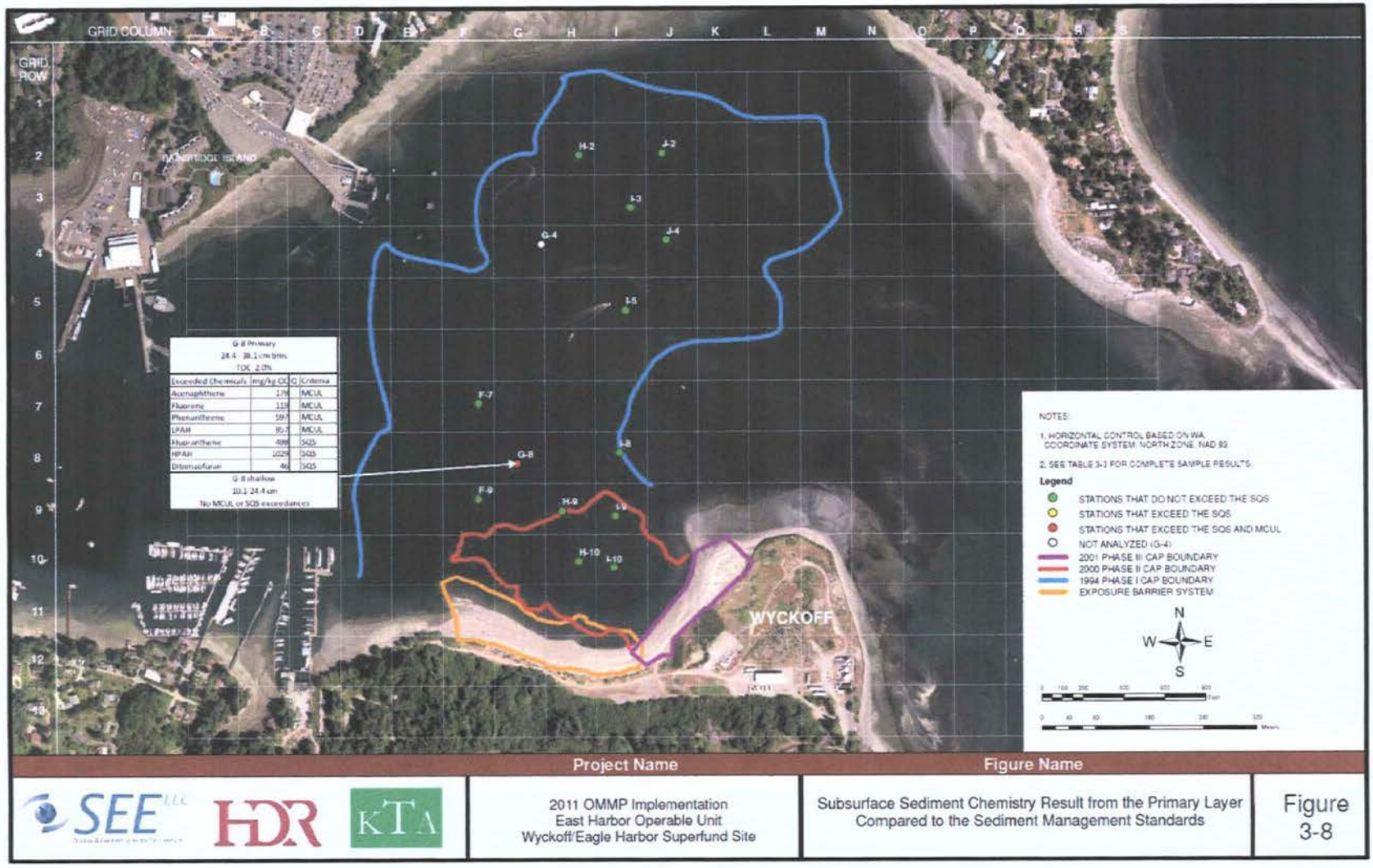


Figure 25. East Harbor OU Subtidal Cap Surface Sediment Results



Project Name	Figure Name	
SEE, HDR, KTA	2011 OMMP Implementation East Harbor Operable Unit Wyckoff/Eagle Harbor Superfund Site	Subsurface Sediment Chemistry Result from the Primary Layer Compared to the Sediment Management Standards	Figure 3-8

Figure 26. East Harbor OU Subtidal Cap Subsurface Sediment Results

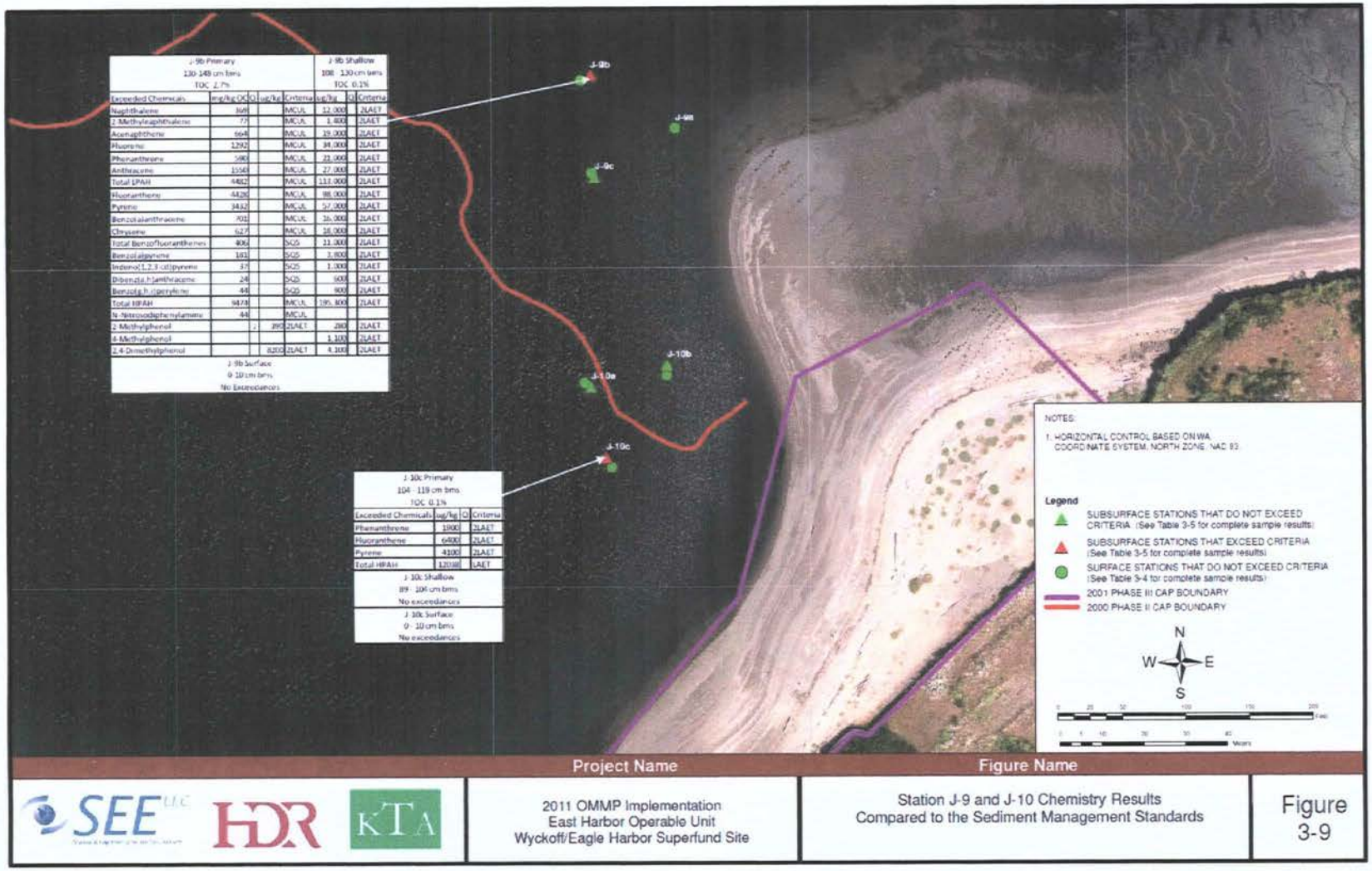
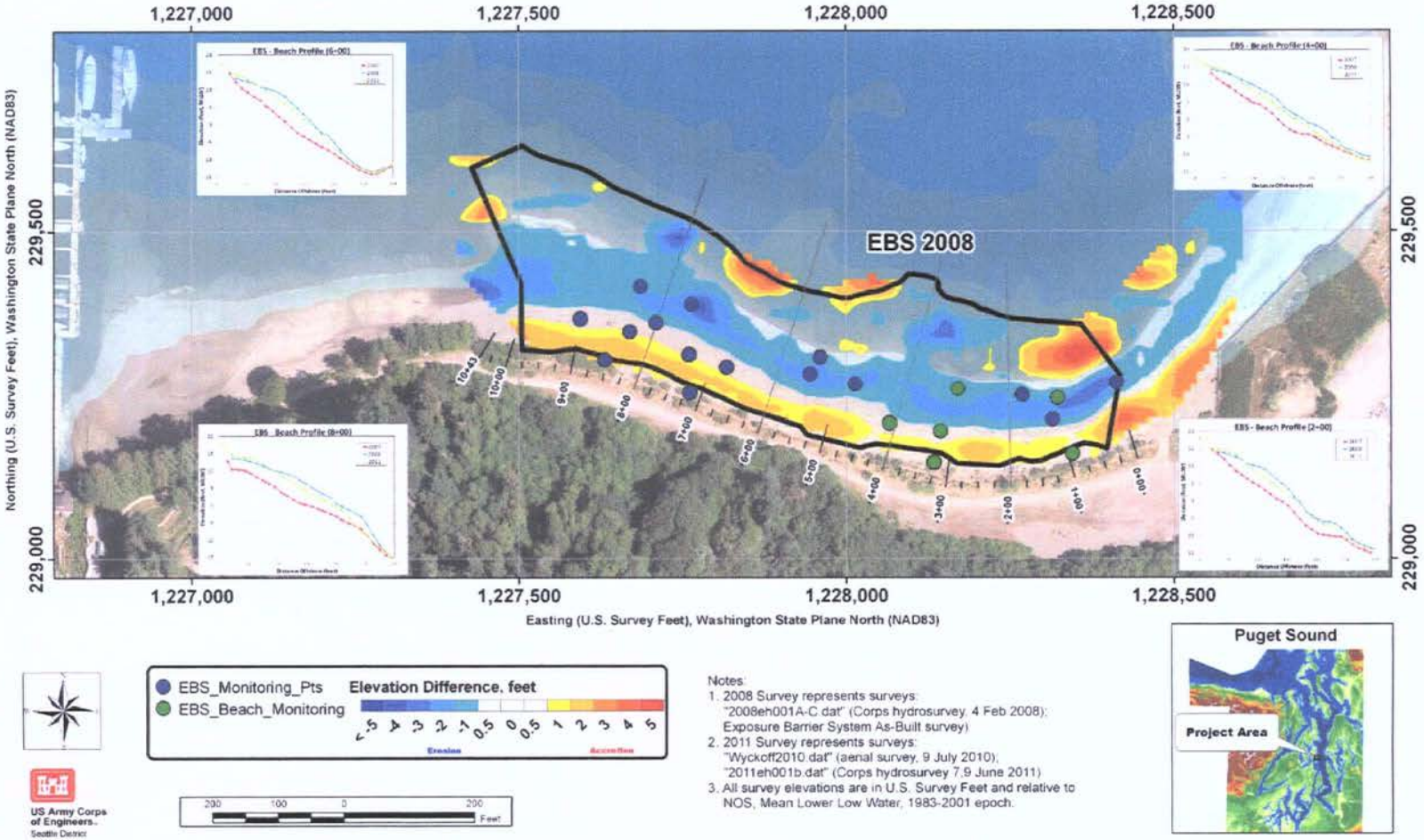


Figure 27. East Harbor OU Grids J-9 and J-10 Results

Figure 3-5
Wyckoff/Eagle Harbor Superfund Site - West Beach (Bainbridge sland, WA)
Elevation Difference (2008 to 2011)



Notes:
1. 2008 Survey represents surveys:
   "2008eh001A-C.dat" (Corps hydrosurvey, 4 Feb 2008);
   Exposure Barrier System As-Built survey)
2. 2011 Survey represents surveys:
   "Wyckoff2010.dat" (aerial survey, 9 July 2010);
   "2011eh001b.dat" (Corps hydrosurvey 7,9 June 2011)
3. All survey elevations are in U.S. Survey Feet and relative to NOS, Mean Lower Low Water, 1983-2001 epoch.

Figure 28. East Harbor OU Exposure Barrier System Elevation Difference 2008 to 2011

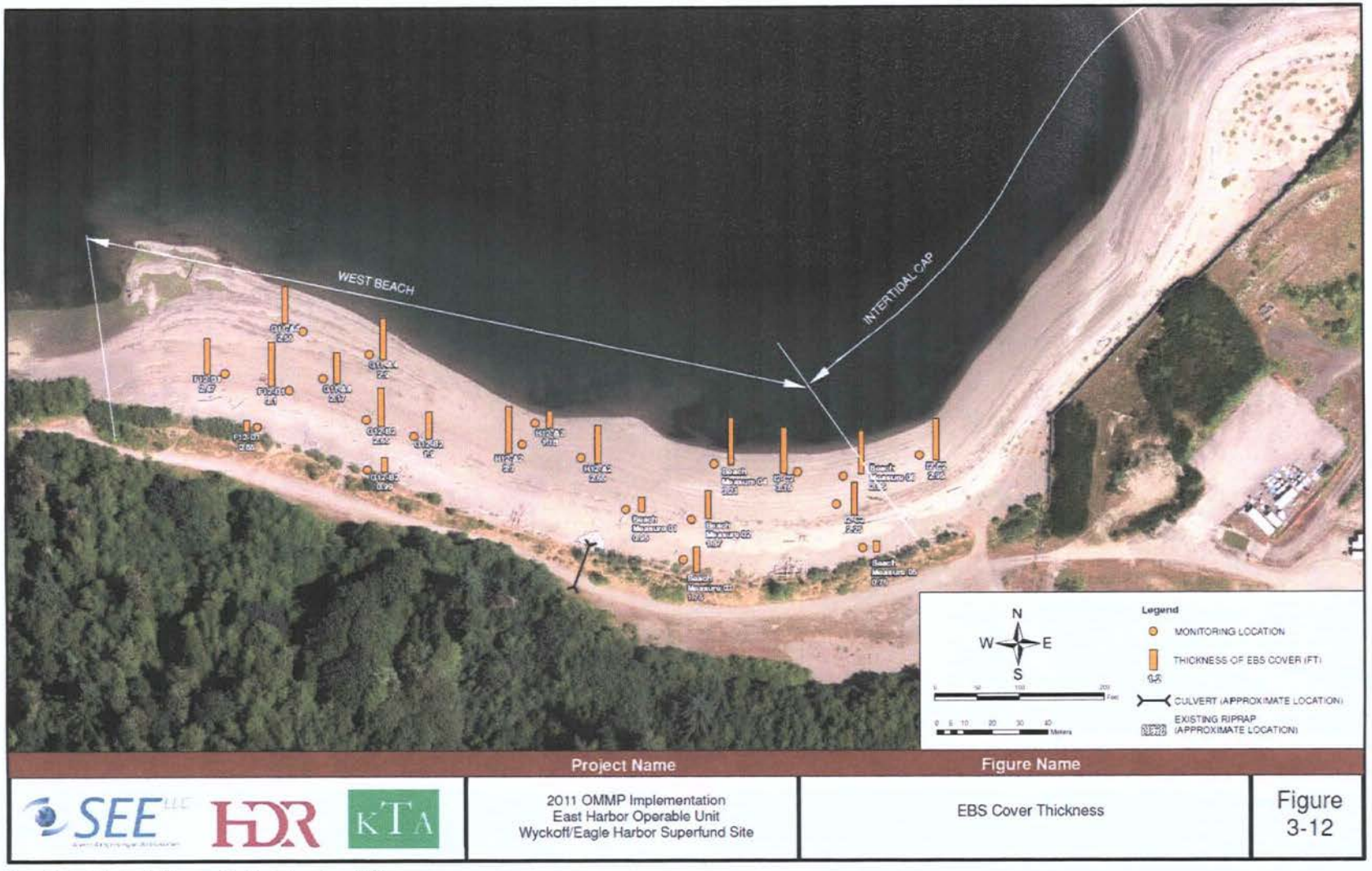


Figure 29. East Harbor OU Exposure Barrier System Cover Thickness

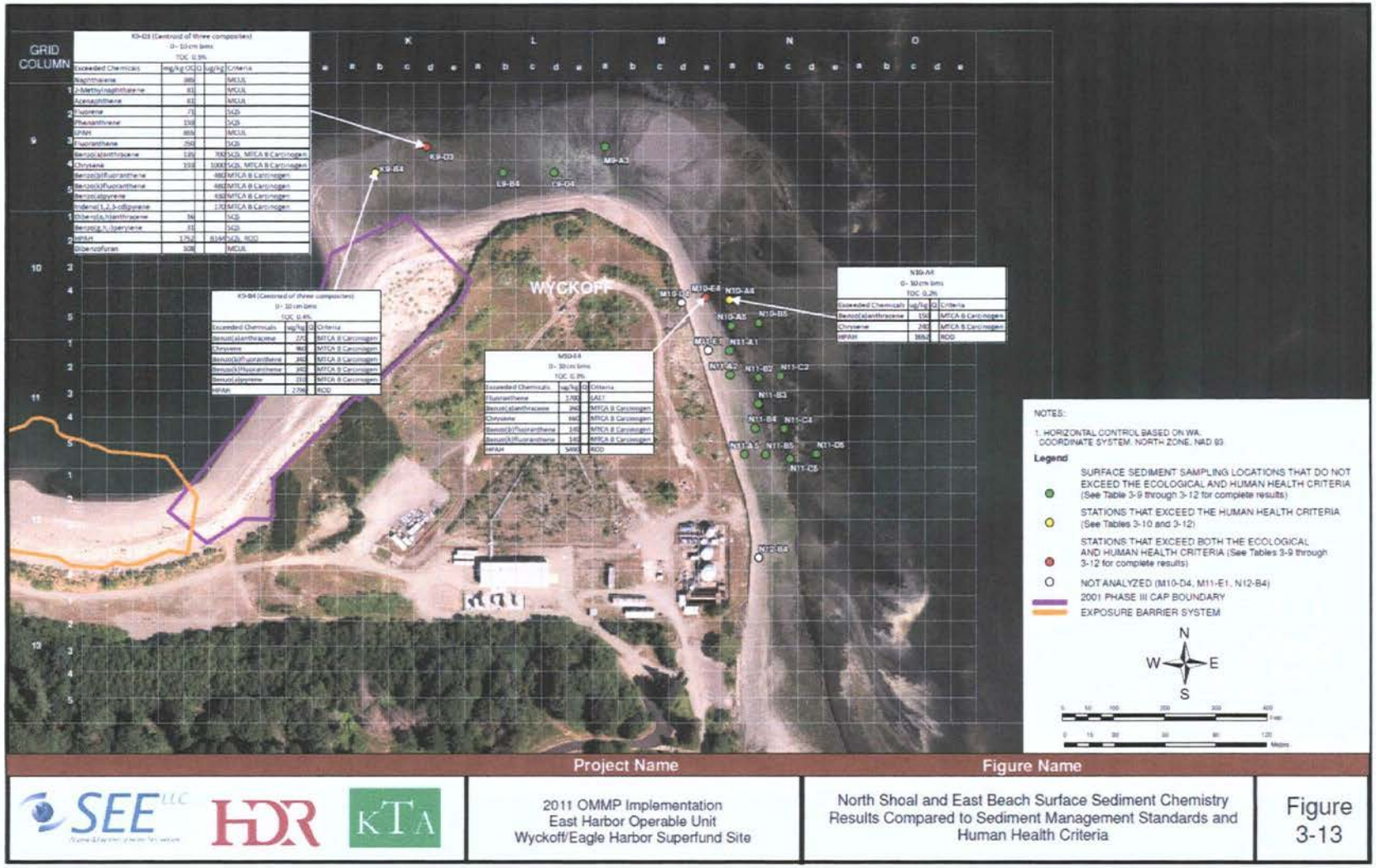


Figure 30. East Harbor OU North Shoal and East Beach Surface Sediment Results

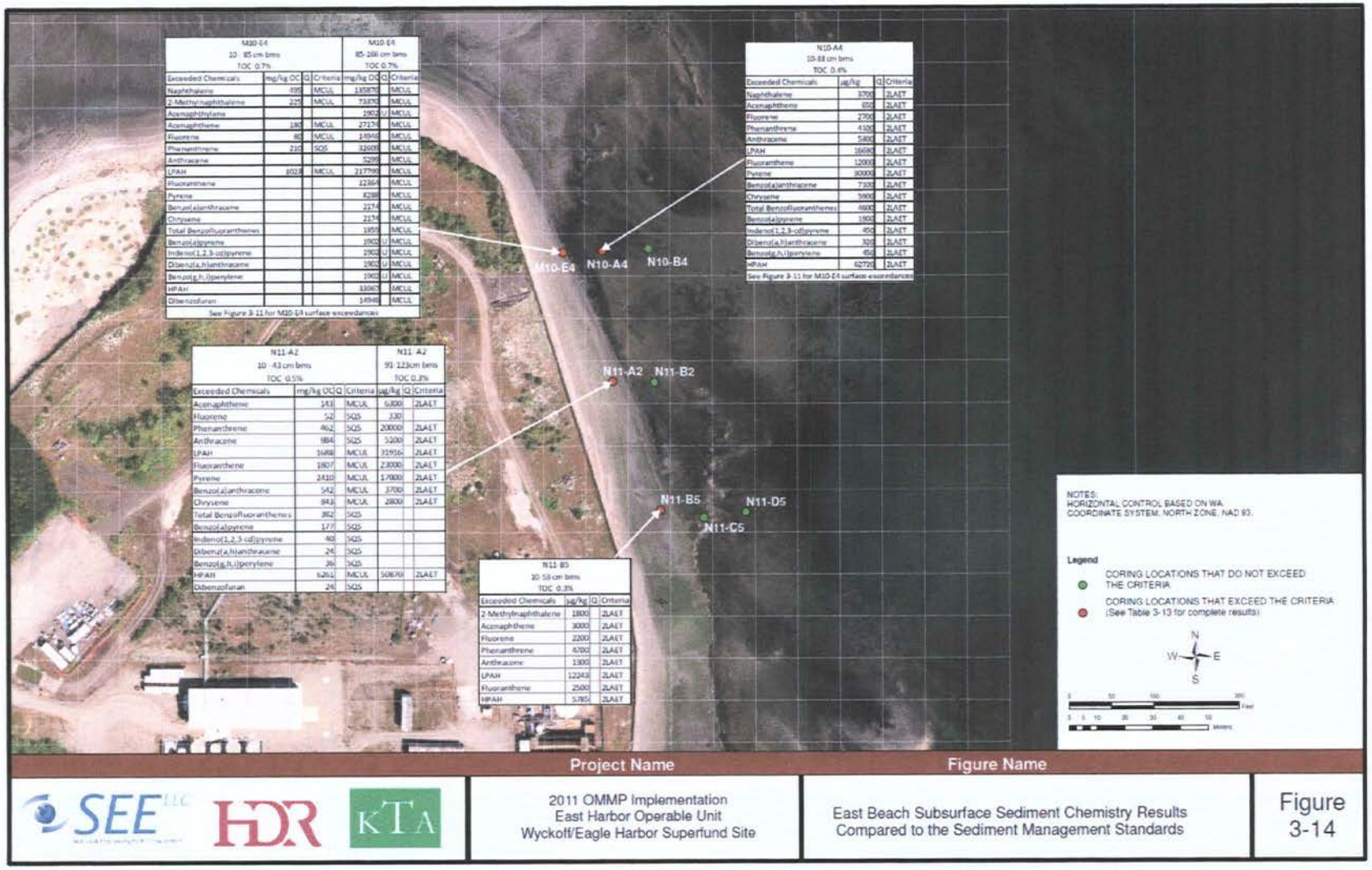


Figure 31. East Harbor OU East Beach Subsurface Sediment Results

APPENDICES

Appendix A List of Documents Reviewed

DOCUMENTS REVIEWED

SOILS AND GROUNDWATER OU

CH2MHill, 2007. Groundwater Conceptual Site Model Update Report for the Former Process Area, Wyckoff/Eagle Harbor Superfund Site, Soil and Groundwater Operable Units. April 2007.

CH2MHill, 2008. January 2008 Groundwater Sampling Results for Wyckoff/Eagle Harbor Superfund Site. April 2008.

CH2MHill, 2009. Technical Memorandum, Soil Boring and Monitoring Well Construction Summary – Wyckoff/Eagle Harbor Superfund Site. January 26, 2009.

CH2MHill, 2009. Technical Memorandum, Evaluation of Wyckoff Groundwater Level Data, December 2008 – March 2009. May 27, 2009.

CH2MHill, 2009. Technical Memorandum, Groundwater Quality Sampling Results for Wyckoff/Eagle Harbor Superfund Site – February 2009.

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Appendix B Site Inspection Checklists

Five-Year Review Site Inspection Checklist for the West Harbor OU

I. SITE INFORMATION	
Site name: Wyckoff/Eagle Harbor	**Date of inspection:** 14 February 2012
Location: Bainbridge Island, Washington	**EPA ID:** WAD009248295
Agency, office, or company leading the five-year review: EPA Region 10	**Weather/temperature:** Raining in the morning; clear and windy in the afternoon/40F

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency:
Contact: _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☒ Readily available — ☐ Up to date — ☐ N/A
   - ☐ As-built drawings — ☒ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Maintenance logs — ☒ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

2. **Site-Specific Health and Safety Plan** — ☒ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

3. **O&M and OSHA Training Records** — ☒ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☒ Effluent discharge — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Other permits _____ — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks: The facility has a NPDES permit for stormwater discharges.

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks _____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks _____

7. **Groundwater Monitoring Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks _____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks _____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☒ Water (effluent) — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks: NDPES discharge records are available.

10. **Daily Access/Security Logs** — ☒ Readily available — ☐ Up to date — ☐ N/A

    Remarks: Visitors to the facility are required to sign in.

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☒ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other _____

2. **O&M Cost Records**

☒ Readily available ☒ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: Fencing surrounds the West Harbor OU. Entrance gates are open during business hours; other gate accesses are secured.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: Signs are present identifying the Washington State Ferries Maintenance Facility and only authorized personnel are allowed within the fenced areas.

C. Institutional Controls (ICs): ***ICs were not discussed during the site visit.***

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____

Frequency _____

Responsible party/agency _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☐ N/A

Other problems or suggestions: ☐ Report attached

_____

_____

_____

_____

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks _____

_____

_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: Theft has occurred at the West Harbor OU.

2. **Land use changes on site** ☐ N/A

Remarks: No land use changes have occurred on site at the West Harbor OU.

3. **Land use changes off site** ☒ N/A

Remarks: _____

_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A A public road is used to access the site.

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface ***(A confined disposal facility (CDF) are present on the West Harbor OU)***

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks: Cracks are seen within the asphalt cover. These cracks are primarily located at seams. The cracks have been sealed. However in some areas, the sealant material is coming up.

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks: Vegetative cover is not used at the West Harbor OU.

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks: An asphalt cover for the landfills and confined disposal facility is present. The asphalt cover is the current parking lot and materials/equipment staging area for the WA State Ferries Maintenance Facility. Along the west side of the facility is armored rock and a sediment containment area.

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident

☐ Wet areas	☐ Location shown on site map	Areal extent	
☐ Ponding	☐ Location shown on site map	Areal extent	
☒ Seeps	☐ Location shown on site map	Areal extent	
☐ Soft subgrade	☐ Location shown on site map	Areal extent	

Remarks: Seeps are monitored on the west side of the facility as part of an annual inspection. Seeps with a flow greater than 1 gpm are sampled for contaminants of concern (metals). Approximately 50 seeps were observed during last year's inspection. Wet spots were observed on the north end of the property in 2007. However, the wet spots disappeared with no determination of the cause.

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent_____
Remarks: The armored rock and sediment containment appear to be good condition. Exposed geofabric (filled with concrete) was observed on the sediment containment area near the footbridge. The slope above the public walking path appears to be stable.

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

C. Letdown Channels ☐ Applicable ☒ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☒ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks: 2 monitoring wells are located within the CDF and are routinely monitored. Both these wells are flush mounted.

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A
Remarks_____

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition G Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____

F. Cover Drainage Layer ☒ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☒ Functioning ☐ N/A
   Remarks: Three oil water separators (OWS) and catch basins are located within the asphalt cap (parking area). The OWS discharge to two outfalls on the west side of the facility. Outlet pipes from catch basins and associated oil water separators were underwater during the site visit which occurred during high tide.

2. **Outlet Rock Inspected** ☒ Functioning ☐ N/A
   Remarks_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident
   Areal extent_____ Depth_____
   Remarks: Surface water discharges from the asphalt cover to the Puget Sound under a NPDES permit.

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☒ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☒ Functioning ☐ N/A
   Remarks: A drainage cutoff system is located at the north end of the site. This intercepts drainage from the slope above. The cutoff system is buried 1' below ground.

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance G N/A
   Remarks_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

C. Treatment System ☐ Applicable ☒ N/A

1. **Treatment Train** (Check components that apply)
   - ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   - ☐ Air stripping ☐ Carbon adsorbers
   - ☐ Filters_____
   - ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   - ☐ Others_____
   - ☐ Good condition ☐ Needs Maintenance
   - ☐ Sampling ports properly marked and functional
   - ☐ Sampling/maintenance log displayed and up to date
   - ☐ Equipment properly identified
   - ☐ Quantity of groundwater treated annually_____
   - ☐ Quantity of surface water treated annually_____

   Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   - ☐ N/A ☐ Good condition ☐ Needs Maintenance

   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   - ☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

   Remarks_____

4. **Discharge Structure and Appurtenances**
   - ☐ N/A ☐ Good condition ☐ Needs Maintenance

   Remarks_____

5. **Treatment Building(s)**
   - ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   - ☐ Chemicals and equipment properly stored

   Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   - ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   - ☐ All required wells located ☐ Needs Maintenance ☐ N/A

   Remarks_____

D. Monitoring Data

1. Monitoring Data
   - ☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring data suggests:
   - ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☒ N/A
Remarks _____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

No other remedies apply to this site.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
The remedy includes the removal of a mercury hotspot and containing the removed sediment upland to the confined disposal facility, a sediment cap, natural recovery and monitoring in areas without the sediment cap, institutional controls to protect from exposure to contaminated fish and shellfish, and long term monitoring. All the elements of the remedy appear to be functioning as intended. The CDF, shoreline protection system and sediment cap are all functioning in protecting human health and the environment from contaminant sources. The long term monitoring is occurring annually and provides a means to assess and determine whether the measures in place are still intact.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
The O&M procedures includes an annual inspection of the remedy to ensure that the asphalt and sediment containment cap are intact, that the OWS and catch basins are functioning to prevent stormwater seepage into the asphalt cap; and the monitoring of seeps and monitoring wells serve to determine whether contamination is still contained. Institutional controls in the form of health advisories are in place.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. No future issues that may affect the protectiveness were discussed or observed during the site inspection.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. O&M procedures and annual inspections appear to be streamlined and efficient. No opportunities for optimization were observed/identified.

Site Inspection Roster:

USACE:	Deborah Johnson, Biologist
	Sharon Gelinas, Geologist
	Marlowe Laubach, Chemical Engineer
	Maleena Scarsella, Environmental Engineer
USEPA:	Howard Orlean, Project Manager
	Rene Fuentes, Hydrogeologist
WSDOT:	Kojo Fordjour, Project Manager
	Nancy Adams, On-site Personnel
Herrera:	Rob Zisette (WSDOT consultant)
WDOE:	Chung Yee, Project Manager
CH2MHill:	Stan Warner, Groundwater Treatment Plant Operator
	Cassie Katzen, Engineer

Five-Year Review Site Inspection Checklist for Soil and Groundwater and East Harbor OUs

I. SITE INFORMATION	
Site name: Wyckoff/Eagle Harbor	**Date of inspection:** 14 February 2012
Location: Bainbridge Island, Washington	**EPA ID:** WAD009248295
Agency, office, or company leading the five-year review: EPA Region 10	**Weather/temperature:** Raining in the morning; clear and windy in the afternoon/40F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls *(S&GOU)*
- ☒ Institutional controls *(EHOU)*
- ☒ Groundwater pump and treatment *(S&GOU)*
- ☐ Surface water collection and treatment
- ☒ Other: *Sediment cap for EHOU*
- ☒ Monitored natural attenuation *(EHOU)*
- ☒ Groundwater containment *(S&GOU)*
- ☒ Vertical barrier walls *(S&GOU)*

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency:
Contact: _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☒ Readily available — ☐ Up to date — ☐ N/A
   - ☐ As-built drawings — ☒ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Maintenance logs — ☒ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

2. **Site-Specific Health and Safety Plan** — ☒ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

3. **O&M and OSHA Training Records** — ☒ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☒ Effluent discharge — ☒ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☐ Other permits _____ — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks _____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks _____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks _____

7. **Groundwater Monitoring Records** — ☒ Readily available — ☐ Up to date — ☐ N/A

   Remarks: Groundwater is monitored at the Soil and Groundwater OU. Last monitoring event was in 2010. Another monitoring event is scheduled for 2012.

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks _____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☒ Water (effluent) — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks: The Soil and Groundwater OU includes the operation of a groundwater treatment system which discharges treated water to the Puget Sound. Discharge data is available.

10. **Daily Access/Security Logs** — ☒ Readily available — ☐ Up to date — ☐ N/A

    Remarks: Visitors to the Soil and Groundwater OU are required to sign in.

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☒ PRP in-house ☐ Contractor for PRP
☒ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other _____

2. **O&M Cost Records**

☒ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: Fencing surrounds the the Soil and Groundwater OU facilities. Entrance gates are open during business hours; other gate accesses are secured.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: East Harbor OU. No signs are posted as this OU is primarily underwater. West Beach has been remediated to allow for unrestricted access and no signs are present. No signs are present at the East Beach or North Shoal alerting the public of the presence of contaminants from past practices. Signs are present on the fence surrounding the Soil and Groundwater OU facing the water alerting the public not to collect shellfish or fish from the area. These signs are too high to be seen by a beachcomber during low tide. A sign stating the presence of the on-going Superfund site actions is present on the entrance gate to the Soil and Groundwater OU.

C. Institutional Controls (ICs):

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☒ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☒ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____

Frequency _____

Responsible party/agency _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☐ N/A

Other problems or suggestions: ☐ Report attached

The Soil/Groundwater OU ROD prescribes the implementation of ICs to ensure the upper aquifer groundwater outside the Former Process Area and the lower aquifer remains unused until protective levels are reached, to ensure the upper aquifer groundwater within the Former Process Area remains unused or remains as part of the contingency remedy, and restrict site use. A Notice of Agreement between the City of Bainbridge and EPA includes an institutional control that prohibits the installation of wells or withdraw groundwater within the Former Process Area without agreement by EPA.

The East Harbor OU ROD ICs include health advisories and use/access restrictions.

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks _____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☐ No vandalism evident

Remarks: Graffiti was observed on the north side of the sheet pile wall surrounding the Soil and Groundwater OU.

2. **Land use changes on site** ☐ N/A

Remarks: No land use changes at the Soil and Groundwater OU. A new park area was constructed on the southeast side of the Soil and Groundwater OU just above the East Beach. An exposure barrier system was constructed in 2008 at the West Beach area.

3. **Land use changes off site** ☐ N/A

Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: A new road was constructed to access the Soil and Groundwater OU facility.

B. Other Site Conditions

Remarks _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks: _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks: _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident

- ☐ Wet areas ☐ Location shown on site map Areal extent_____
- ☐ Ponding ☐ Location shown on site map Areal extent_____
- ☐ Seeps ☐ Location shown on site map Areal extent_____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks: _____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent_____

Remarks_____

_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay

Remarks_____

_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay

Remarks_____

_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay

Remarks_____

_____

C. Letdown Channels ☐ Applicable ☐ N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement

Areal extent_____ Depth_____

Remarks_____

_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation

Material type_____ Areal extent_____

Remarks_____

_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion

Areal extent_____ Depth_____

Remarks_____

_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks: _____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A
Remarks_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition G Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS ☒ Applicable ☐ N/A

(The Soil and Groundwater OU has vertical sheet pile walls as part of the containment remedy.)

1. **Settlement** ☐ Location shown on site map ☒ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☒ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks: The sheet pile wall is currently rusting; with flaking observed more on the east side compared to the north and west sides of the wall. No monitoring has been performed to evaluate whether the sheet pile thickness has decreased over the years. The sheet pile wall was installed in 2001.

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks: _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☒ Good condition ☐ Needs Maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs Maintenance
   Remarks _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   - ☐ Metals removal ☒ Oil/water separation: Dissolved Air Flotation ☐ Bioremediation
   - ☐ Air stripping ☒ Carbon adsorbers: 5 adsorbers in series with 3 always online.
   - ☒ Filters: Walnut shell filter ahead of the carbon adsorbers
   - ☒ Additive (*e.g.*, chelation agent, flocculent): Polymers used to aid in oil/water separation in DAF
   - ☐ Others_____
   - ☒ Good condition ☐ Needs Maintenance
   - ☒ Sampling ports properly marked and functional
   - ☐ Sampling/maintenance log displayed and up to date
   - ☒ Equipment properly identified
   - ☐ Quantity of groundwater treated annually_____
   - ☐ Quantity of surface water treated annually_____

   Remarks: The treatment plant was completed and online in April 2010. The old treatment plant was demolished in 2011.

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☒ Good condition ☐ Needs Maintenance

   Remarks: MCC panels for some the extraction wells are located in the control building of the old treatment plant. Currently water is seeping into the control building which may interfere with the operation of the extraction wells and safety of onsite personnel.

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

   Remarks: Equalization tanks and product storage tanks are also new; constructed with the new treatment plant.

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☒ Good condition ☐ Needs Maintenance

   Remarks_____

5. **Treatment Building(s)**
   ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair
   ☒ Chemicals and equipment properly stored

   Remarks: The new treatment plant became online in 2010. The old treatment plant was demolished in 2011.

6. **Monitoring Wells** (pump and treatment remedy)
   ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A

   Remarks: All monitoring wells located outside of the secured area were locked.

D. Monitoring Data

1. Monitoring Data
   ☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring data suggests:
   ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

   Remarks: Monitoring data is used to determine whether hydraulic containment is functioning.

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☒ N/A
Remarks _____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

The East Harbor OU remedy also includes capping contaminated subtidal and intertidal sediments. Several caps have been implemented through the years. A monitoring event occurred in 2011 to evaluate sediment contaminant concentrations and cap integrity. A draft report will be available in March 2012. Based on the results of this report (once finalized), follow-on work may occur in the future. In addition to the capping remedy is natural recovery of the North Shoal and East Beach areas.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Soil and Groundwater OU: The contingent remedy for this OU is hydraulic control and containment of contaminants. The installed sheet pile wall contains NAPL still present below ground surface. However, sheens and odors still exist outside the sheet pile wall. The sources of these are unknown. New wells and transducers were installed in 2009 to help better evaluate hydraulic control. Data shows that sometimes hydraulic control is not present in some well pairs but no recent evaluation of the data has been performed showing that hydraulic control throughout the sight has/has not been met.

East Harbor OU: Several caps have been implemented through the years with the EBS constructed in 2008. Monitoring of the caps is on-going.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Soil and Groundwater OU: The new groundwater treatment plant is operated through a process control program with remote control capabilities. Hydraulic control during high water season has been a challenge but with the newer monitoring equipment operations can be adjusted sooner to maintain hydraulic control.

East Harbor OU: Continual monitoring of the caps and natural recovery has been adequate to determine whether the remedy is still functioning as intended.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. The sheet pile wall integrity has not been assessed for a number of years. The failure of this wall would affect the protectiveness of the contingency remedy.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Optimization of the groundwater treatment plant operations may help with maintaining hydraulic control during periods of high water.

Site Inspection Roster:

USACE:	Deborah Johnson, Biologist
	Sharon Gelinas, Geologist
	Marlowe Laubach, Chemical Engineer
	Maleena Scarsella, Environmental Engineer
USEPA:	Howard Orlean, Project Manager
	Rene Fuentes, Hydrogeologist
WSDOT:	Kojo Fordjour, Project Manager
	Nancy Adams, On-site Personnel
Herrera:	Rob Zisette (WSDOT consultant)
WDOE:	Chung Yee, Project Manager
CH2MHill:	Stan Warner, Groundwater Treatment Plant Operator
	Cassie Katzen, Engineer

Appendix C Site Inspection Photographs

Photo 1. WHOU. Crack sealing on asphalt cap.

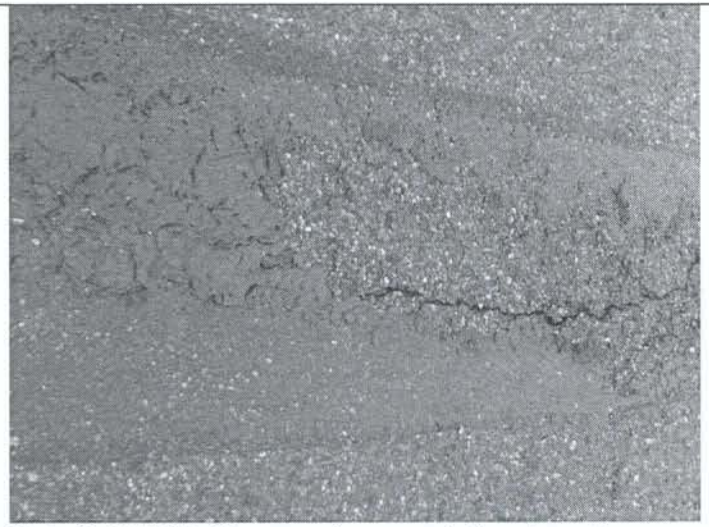


Photo 2. WHOU. Close-up of poor asphalt seal repair.

Photo 3. WHOU. Overview of site from northern edge (taken from northern walkway).

Photo 4. WHOU. Wet spot along walkway at northern edge. Northern cutoff drainage system installed below walkway.

Photo 5. WHOU. Tidal barrier at north end of site; geofabric exposed.

Photo 6. WHOU. Seep locations (below water) at north end of site.

Photo 9. WHOU. Catch basin and oil water separator at Outfall 1.

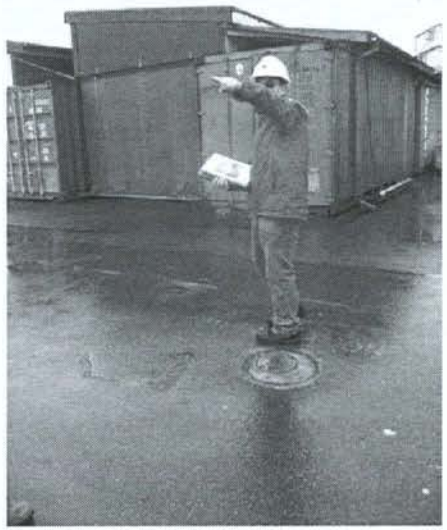


Photo 10. WHOU. Piezometer PZ-03 within CDF area.

Photo 11. WHOU. Peizometer PZ-02 within CDF area.

Photo 12. WHOU. Catch Basin 5 near maintenance building.

Photo 13. EHOU. West Beach cover system area.

Photo 14. EHOU. East Beach area.

Photo 15. EHOU. Warning signs and fence at East Beach.

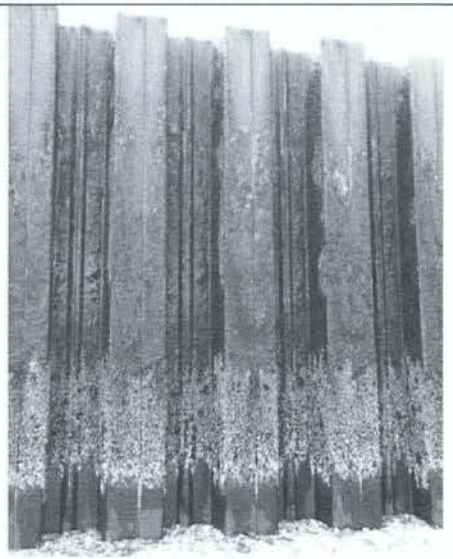


Photo 16. EHOU. Sheetpile corrosion.

Photo 17. EHOU. Closeup of sheetplie corrosion.

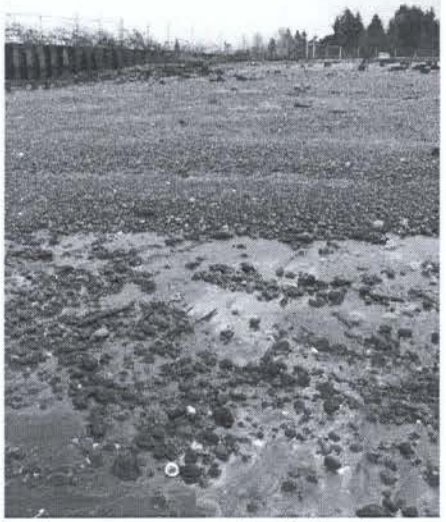


Photo 18. EHOU. Sheen on seeps at North Shoal

Photo 19. S&GOU. DAF system in treatment plant.

Photo 20. S&GOU. GAC tanks in treatment plant.

Photo 21. S&GOU. Effluent tanks at treatment plant.

Photo 21. S&GOU. Location of former treatment plant building.

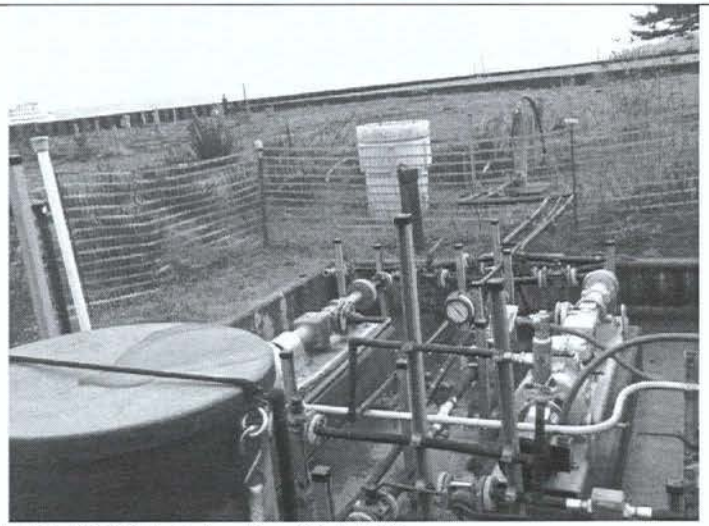


Photo 23. S&GOU. Extraction Well PW7.

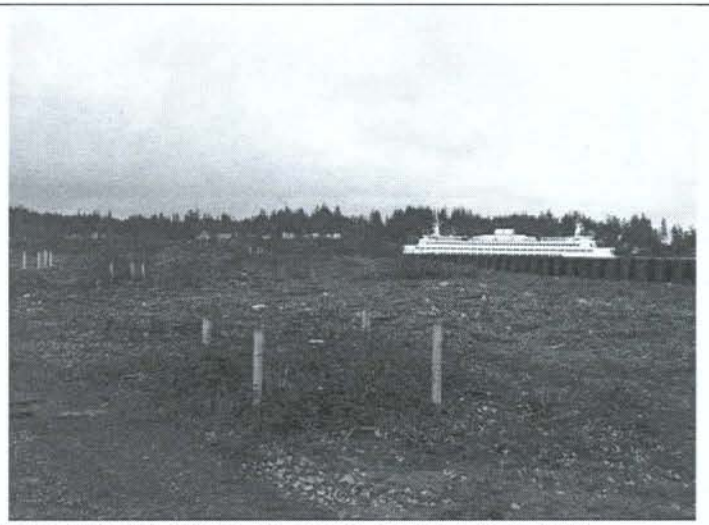


Photo 24. S&GOU. Monitoring wells near sheetpile wall.

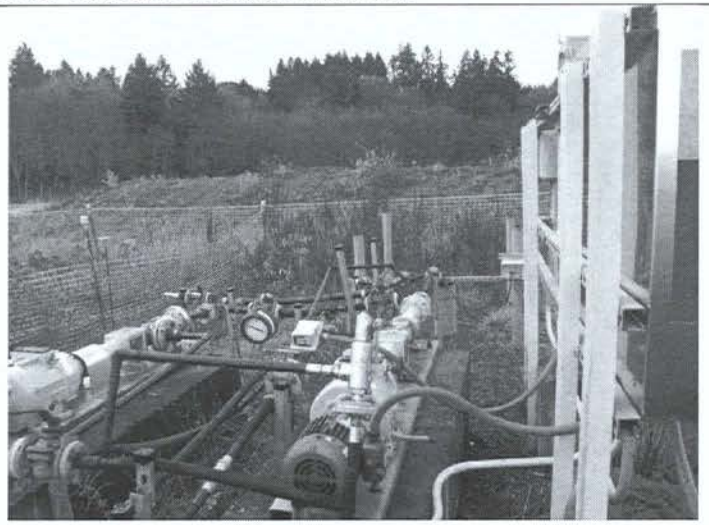


Photo 25. S&GOU. Extraction well PW5.

Photo 26. S&GOU. Upgradient monitoring wells.

Appendix D Interview Transcripts

Wyckoff/Eagle Harbor Superfund
Third Five-Year Review
Interviews

Wyckoff/Eagle Harbor Superfund Site
Interviewees and dates interviews were conducted:

Local

- Perry Barrett – Bainbridge Island Metro Park and Recreation District(Senior Planner)
  Interviewed on 18 April 2012

State

- Kojo Fordjour – Washington State Ferries
  Interviewed on 19 April 2012

- Chung Yee – Washington Department of Ecology
  Questionnaire completed on 24 April 2012

Tribal

- Rich Brooks – Suquamish Tribe
  Interviewed on 23 May 2012

Community

- Charles Schmid – Association of Bainbridge Communities (Secretary/Treasurer)
  Interviewed on 19 April 2012

- Private Citizen (name withheld)
  Interviewed on 1 May 2012

Interview Record: Perry Barrett (Bainbridge Island Metro Park and Recreation District)

1. What is your overall impression of the Wyckoff/Eagle Harbor Superfund Site (general sentiment)?
It is an exciting project that continues to evolve. The Japanese American memorial [located at the western portion of the site] has National Park Service affiliation.
2. What is your current role and your agency's role with respect to the site?
The Parks and Recreation department are co-owners of Prichard Park and the City of Bainbridge owns "the Point". However, there are negotiations to switch that ownership from the City to the Parks (a separate entity from the City). The land transfer was paid with bond monies. It is anticipated that the City portion (tidal and upland areas of "the Point") will be transferred to the Parks within a year.
3. Have there been routine communications or activities (for example site visits, inspections, etc.) conducted by your office regarding the site? If so, please give purpose and results.
Mr. Barrett is included in the regular phone calls with Howard Orlean (EPA). They will move the fence on the non-contaminated portion of the property to comply with the requirements of the American Disabilities Act (ADA). They are anticipating adding a new access road (also ADA compliant) as part of their shoreline restoration.
4. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.
The State of Washington has general community outreach (Tim Nord with Department of Ecology). This coordination includes the Japanese American memorial wall, National Park Service coordination, and Phase II agreement on O&M. They [Parks and Recreation] own 8.5 acres at Prichard Park. They were involved with the owner of the marina to the west but that was resolved as per the restoration. They completed a comprehensive plan for the Park in 2008 and 2009 with the local community (also on the web-site). They will continue to present concepts for usage after cleanup is completed. They closely coordinate the restoration elements with the City.
5. Do you feel well informed about the site's activities and progress?
Yes. The weekly call makes the process very transparent.
6. Are you aware of any changes in State/County/Local laws and regulations that may impact the protectiveness of the site?
No. The Shoreline Management Plan is in the process of being updated and that will include a cumulative impact statement. The information is on the City of Bainbridge web page.
7. Do you have any comments, suggestions, or recommendations regarding the site's management, operation, or any other aspects of the site?
Mr. Barrett feels that there is great progress on the cleanup and the work with the local community is sufficient.

Interview Record for Kojo Fordjour (Washington State Ferries)

1. What is your overall impression of the Wyckoff/Eagle Harbor Superfund Site (general sentiment)?
Mr. Fordjour feels that the site (West Harbor OU) site looks great and that are down to visual inspections [compared to] the significant monies spent in the earlier phases of the cleanup on this property.
2. What is your current role and your agency's role with respect to the site?
They [Washington State Ferries] own the site and comply with the consent judgment. Mr. Fordjour is the project manager for the OMMP implementation.
3. Have there been routine communications or activities (for example site visits, inspections, etc.) conducted by your office regarding the site? If so, please give purpose and results.
They [Washington State Ferries] conduct routine site visits and prepare required reports. They have a[n upcoming] meeting with EPA to review the last report for finalization.
4. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.
None in the last five years.
5. Do you feel well informed about the site's activities and progress?
Mr. Fordjour is consulted very month and the staff is on-site. They are currently in compliance with their NPDES permit. There were concerns with the Paccar Company that used to operate on the site but they no longer are an authorized user (potential liable party).
6. Are you aware of any changes in State/County/Local laws and regulations that may impact the protectiveness of the site?
They are tracking the Master Shoreline Update and so far there is nothing to impact the site operations. There are no changes to the NPDES permit and they have had no violations in the last five years. They did not high Zn levels during the construction of metal buildings but actions were taken to resolve that issue.
7. Do you have any comments, suggestions, or recommendations regarding the site's management, operation, or any other aspects of the site?
Mr. Fordjour would like to know if there is an end in sight as they are concerned that continued funding will not be adequate to maintain the required O&M of the consent decree. They would like to consider the potential to reduce inspections to every five years instead of the current yearly requirement. They feel this is appropriate since NPDES monitoring is an annual requirement which would suffice.

Interview Record for Chung Yee (Washington Department of Ecology)

1. What is your overall impression of the Wyckoff/Eagle Harbor Superfund Site (general sentiment)?
This is a complex site encompassing both in-water and upland contamination. Overall, with the exception of the North Shoal/East Beach, EPA has successfully completed cleanup via capping for the East Harbor Operable Unit. The recent Year 11 operations and maintenance monitoring activities identified remedy maintenance activities for the East Harbor Operable Unit. These will need to be addressed by EPA. EPA will be conducting site investigation for North Shoal/East Beach and we are hopeful that a cleanup remedy will be selected and implemented in the near future. EPA has implemented a containment system for the Former Process Unit (Soil Operable Unit and Groundwater Operable Unit). This remedy provides temporary control of the residual contamination at the upland area. EPA will be conducting site investigation and engineering evaluation to address the upland residual contamination. We are hopeful that a permanent contaminant source reduction remedy will be selected and implemented in the near future.
2. What is your current role and your agency's role with respect to the site?
I am the Ecology staff assigned to this site. Ecology is the support agency for three of the four operable units for this site (East Harbor Operable Unit, Soil Operable Unit, and Groundwater Operable Unit). The Department of Transportation is responsible for the West Harbor Operable Unit. In addition to provide assistance to EPA, Ecology per the 2012 Superfund State Contract, for the next two years is responsible for the operations and maintenance of the on-site groundwater extraction and treatment system.
3. Have there been routine communications or activities (for example site visits, inspections, etc.) conducted by your office regarding the site? If so, please give purpose and results.
I have participated in the weekly coordination conference calls.
4. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.
No. I have not received any complaints on this site.
5. Do you feel well informed about the site's activities and progress?
Yes, I have been well informed by EPA's Remedial Project Manager, Mr. Howard Orlean, on the site's activities and progress.
6. Are you aware of any changes in State/County/Local laws and regulations that may impact the protectiveness of the site?
No.
7. Do you have any comments, suggestions, or recommendations regarding the site's management, operation, or any other aspects of the site?
No. I am satisfied with Mr. Orlean's management of the site.

Interview Record for Rich Brooks (Suquamish Tribe)

1. What is your overall impression of the Wyckoff/Eagle Harbor Superfund Site (general sentiment)?
The Tribe supports the current direction of activities at the Wyckoff/EH site, and EPA's efforts of evaluating thermal remediation as a remedy for the Wyckoff operable units. The Tribe strongly prefers the significant, or mass, removal of contaminants at the Wyckoff operable units as part of the final cleanup remedy. The Tribe continues to have concerns of the vertical and horizontal extent of PAH contamination within and adjacent to the "East Beach" area, and supports EPA's planned activities within the East Beach area. The Tribe also continues to have concerns of contaminant levels in fishery resources that are above acceptable human health risk levels for Tribal harvesters.
2. What is your current role and your agency's role with respect to the site?
The Suquamish Tribe is a federally-recognized tribe with treaty fishing rights within the Wyckoff/EH site boundaries. Bainbridge Island is also within the traditional territory of the Suquamish Tribe. The Tribe is interested in protecting Tribal trust resources, Treaty-reserved rights, and cultural resources that are of religious or cultural importance to the Tribe. The Suquamish Tribe currently has funding for Tribal participation through an EPA Support Agency Cooperative Agreement.
3. Have there been routine communications or activities (for example site visits, inspections, etc.) conducted by your office regarding the site? If so, please give purpose and results.
The Tribe has good communications with the current EPA RPM. The Tribe meets with EPA to discuss project updates, schedules, and site documents.
4. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.
None
5. Do you feel well informed about the site's activities and progress?
Please refer to answer to question #3..
6. Are you aware of any changes in State/County/Local laws and regulations that may impact the protectiveness of the site?
No.
7. Do you have any comments, suggestions, or recommendations regarding the site's management, operation, or any other aspects of the site?
The Tribe appreciates EPA's efforts to incorporate monitoring requirements specified in the Draft 95% Design Analysis Compensatory Mitigation (June 22, 2000) and the West Beach Exposure Barrier System Biological Assessment (May 2007) in the East Harbor 2011 OMMP.

Interview Record for Charles Schmid, Association of Bainbridge Communities

1. What is your overall impression of the site (general sentiment)?
EPA has cleaned up or capped most of the site. Good that EPA took down the old waste treatment plant and built a new waste treatment plant. Still disappointed that no cleanup action has occurred at the Point and of the estimated time for cleanup; approximately 100 years. There was a special task force established to determine cleanup up alternatives at the Point. Also appreciated the eastern beach restoration, [EPA] did a good job. However, there are still oily seeps on the eastern shore. Association of Bainbridge Communities (ABC) inquired about these and was told that these were residual amounts of oil that will eventually go away. But they're [oily seeps] still there.
2. What effects have site operations had on the surrounding community?
Slowly the people are appreciating the beach and the increase in [usable] shoreline. Kids are swimming there; we were told that swimming was okay. I've seen kayakers pull up on the beach. Lots of people with dogs. The Japanese Memorial [on the west end] of the site is well done.
3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
No additional concerns other than those expressed earlier. The timeframe of cleanup at the Point is of concern. Something that ABC is doing is constructing a 3'x6' kiosk [to be built by an Eagle Scout] that talks about the history of the creosote facility and the cleanup. Most people are not aware of the current cleanup work.
4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses? If so, please give details.
Heard that there were cuts in the fence [surrounding the site] and tools were taken. Something not related to EPA, was that county sprayed herbicides to take of the Japanese knotweed, an invasive species. In doing so, killed a couple trees.
5. Do you feel well informed about the site's activities and progress?
If big events are to happen then we are informed. If we need information, we ask for it. Mr. Schmid asked whether a public meeting will be held after the draft report will occur.
6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation? Would like follow-up on the Generational Remedy report [that resulted from the steering committee/task force that was established to determine cleanup alternatives for the Point.] Also would like an estimate of how long the steel wall be [continue] to be used for containment. [Regarding] the cyclone fence that runs along the [groundwater] treatment plant and the steep part of the hillside, EPA and the city said they would move [the fence] a few feet toward the plant for ADA and emergency vehicles.

Interview Record for Private Citizen (name withheld)

1. What is your overall impression of the site (general sentiment)?
Currently the site is a good space. They did a good job of cleaning up what was there and the improvements to the area – road, trails, plantings by shore makes it look nice. Within the wall all the old buildings were removed. People feel positive of the space and people are enjoying it.
2. What effects have site operations had on the surrounding community?
Once the [new] road was in people are happy with what's there now. The community is poised and waiting to see what is going to happen next; with the transition from EPA to DOE.
3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
Community concerns are related to who's going to maintain the site and how. There was a huge community support to buying the site including [the area that is now] Pritchard Park. The community felt that EPA had a good technique with steam and bacterial treatment; initial results had looked promising. When that process ramped up and it didn't work it was disappointing. The community was also confused as to why it didn't work. People were a little angry. In speaking to people who were knowledgeable of that process it appears that the materials [of construction] were inadequate, not enough money was spent on cleanup equipment. It seems that EPA abandoned [this process] because of cost reasons, not because [it couldn't achieve] long-term remediation. The current issue is that the community is concerned that the EPA has given up on the site and gave it to DOE to continue. People feel this is not appropriate and that there are leaks present on the outside of the wall. Since this is in a fault area, there may be a breach in the [sheet pile] wall.
4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses? If so, please give details.
Not aware of any.
5. Do you feel well informed about the site's activities and progress?
I personally do because I've been involved [with the site] so long and have had subsequent conversations with DOE [after the week meeting to determine alternatives for remediation].
6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
It would be helpful if a public meeting were held [to inform the community where things are]. There is an importance and value to explain what's going on [at the site] as the [Bainbridge Island] community is highly engaged. Ideally, it would be a joint meeting with EPA and DOE. The EPA should make sure folks [conducting] the meeting have the technical knowledge and are [articulate] to honestly and openly explain what's been going on at the site. If EPA needs assistance, they can contact folks [on Bainbridge Island] who have been involved [with the site.]

Appendix E Data

Appendix E – Data

1. S&G OU, Extraction well operation summary, 2007-2011
2. S&G OU, Vertical well pair negative gradients and cumulative precipitation, 2007-2011
3. S&G OU, Average gradients per monitoring period
4. S&G OU, Groundwater sampling results summary, 2007-2011
5. S&G OU, Contaminant concentration over time
6. WHOU, Summary of site and stormwater Inspections at Eagle Harbor, Year 10-14 (2007-2011)
7. WHOU, Piezometer water level monitoring results
8. WHOU, Water quality monitoring data, 2006-2011
9. WHOU, Dissolved copper and zinc concentrations at seep monitoring locations.
10. EHOU, Subtidal thickness comparisons over time
11. EHOU, Subtidal surface sediments results
12. EHOU, Subtidal subsurface sediment results
13. EHOU, J9-J10 surface sediment results
14. EHOU, J9-J10 subsurface sediment results
15. EHOU, University of Texas sediment results
16. EHOU, Intertidal/EBS sediment results compared to sediment management standards (SMS)
17. EHOU, Intertidal/EBS sediment results compared to human health standards (HHS)
18. EHOU, EBS cover measurements
19. EHOU, North Shoal surface sediment results compared to SMS
20. EHOU, North Shoal surface sediment results compared to HHS
21. EHOU, East Beach surface sediment results compared to SMS
22. EHOU, East Beach surface sediment results compared to HHS
23. EHOU, East Beach subsurface sediment results compared to SMS
23. EHOU, Clam survey total PAH results
24. EHOU, Clam survey cPAH results
25. EHOU, Bird survey results
26. EHOU, Invertebrate and macroalgae survey results
27. EHOU, Forage fish egg survey results
28. EHOU, Ingestion of clams risk calculation

1. S&G OU, Extraction Well Operation Summary, 2007-2011

		Extraction Well											
		1		2		3		4		5		6	
Date	Days	days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)
Jan-07	31	7	4.8	7	8.8			7	5.2	7	7.2	7	5.5
Feb-07	28	2	4.8	2	9.5			2	5.4	2	8.8	0	5.1
Mar-07	31	0	5.7	0	10.4			0	5.9	0	9.7	0	6.0
Apr-07	30	3	4.6	3	7.5			3	4.5	3	7.2	3	4.5
May-07	31	0	4.5	0	8.3			0	5.2	0	8.2	0	5.4
Jun-07	30	0	3.8	0	8.3			0	5.2	0	8.4	0	5.3
Jul-07	31	0	4.4	0	8.2			0	4.9	0	8.7	0	5.6
Aug-07	31	0	4.2	0	7.9			0	5.2	0	8.3	0	5.6
Sep-07	30	0	4.3	0	6.0			0	5.2	0	6.7	0	4.9
Oct-07	31	0	2.7	0	5.6			0	4.9	0	6.5	0	5.3
Nov-07	30	0	3.3	0	6.0			0	4.9	0	6.5	0	6.0
Dec-07	31	0	6.6	0	9.7			0	5.3	8	5.5	0	5.3
Jan-08	31	9	4.6	9	7.7			9	5.0	9	6.4	9	4.3
Feb-08	29	0	5.9	0	10.5			0	7.4	0	8.7	0	5.5
Mar-08	31	0	5.0	0	10.1			0	6.3	0	8.0	0	5.3
Apr-08	30	0	4.6	0	9.0			0	5.8	0	8.7	0	5.9
May-08	31	0	4.8	0	9.2			0	6.0	0	9.0	0	6.0
Jun-08	30	1	3.5	1	8.8			1	5.7	1	8.4	1	5.1
Jul-08	31	0	3.0	0	8.5			0	5.4	0	8.4	0	4.6
Aug-08	31	3	4.3	3	6.2			27	0.6	3	7.2	3	4.7
Sep-08	30	0	4.8	1	6.4			0	5.4	0	7.3	1	5.8
Oct-08	31	0	5.9	0	7.4			0	5.9	0	6.9	0	5.1
Nov-08	30	0	5.9	0	8.7			0	6.4	0	6.7	0	5.2
Dec-08	31	18	2.3	18	3.5			18	2.6	18	2.8	18	2.2
Jan-09	31	1	6.1	1	8.6			1	6.4	1	6.8	1	5.4
Feb-09	28	0	5.2	0	7.4			0	6.1	0	7.6	0	5.0
Mar-09	31	5	4.3	5	6.1			6	5.3	5	6.8	5	4.3
Apr-09	30	5	2.4	5	3.6			5	3.6	26	0.7	29	0.3
May-09	31	0	2.6	0	4.8			0	4.1	26	0.0	26	0.0
Jun-09	30	26	0.3	26	0.6			26	0.4	30	0.0	30	0.0
Jul-09	31	31	0.0	31	0.0			31	0.0	31	0.0	31	0.0
Aug-09	31	30	0.0	30	0.0			30	0.0	30	0.0	30	0.0
Sep-09	30	21	0.8	21	1.4			21	1.5	30	0.0	30	0.0
Oct-09	31	22	0.7	22	1.2			22	0.8	29	0.0	29	0.0
Nov-09	30	11	1.6	11	2.3			11	1.3	18	0.0	18	0.0
Dec-09	31	15	2.5	15	3.8			15	3.1	15	3.7	15	4.1
Jan-10	31	11	3.7	11	4.0			11	4.0	11	5.3	11	3.6
Feb-10	28	8	4.2	8	5.0			8	4.2	8	5.8	8	3.9
Mar-10	31	8	3.3	8	4.6			8	4.3	8	5.8	8	3.8
Apr-10	30	8	2.6	8	4.6			8	3.7	8	6.1	8	3.9
May-10	31	11	2.4	11	4.0			24	0.9	11	5.7	11	3.2
Jun-10	30	8	2.9	8	4.5			30	0.0	8	6.4	8	3.6
Jul-10	31	22	1.2	22	1.9			31	0.0	22	2.6	22	1.4
Aug-10	31	31	0.0	31	0.0			31	0.0	31	0.0	31	0.0
Sep-10	30	14	2.4	14	3.6			30	0.0	14	3.7	14	2.7
Oct-10	31	10	2.8	10	4.4			31	0.0	10	4.7	10	3.1
Nov-10	30	13	4.6	13	6.5			30	0.0	13	7.4	13	4.5
Dec-10	31	12	7.0	12	9.5			21	3.7	12	9.6	12	6.3

1. S&G OU, Extraction Well Operation Summary, 2007-2011

Date	Days	Extraction Well											
		1		2		3		4		5		6	
		days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)
Jan-11	31	8	5.5	8	7.9			8	4.9	8	7.7	8	5.6
Feb-11	28	5	5.8	5	5.6			5	6.0	5	8.2	5	6.1
Mar-11	31	3	6.1	2	9.7			2	7.1	2	8.9	2	6.6
Apr-11	30	0	6.5	0	11.2			0	8.0	0	10.1	0	6.9
May-11	31	0	5.0	0	8.4			0	5.4	0	8.4	0	5.2
Jun-11	30	0	4.8	0	8.3			0	4.8	14	4.0	0	5.5
Jul-11	31	17	2.0	17	3.4			17	2.1	17	3.3	17	2.2
Aug-11	31	31	0.0	31	0.0			31	0.0	31	0.0	31	0.0
Sep-11	30	12	2.6	12	3.5			12	3.0	12	4.2	12	3.1
Oct-11	31	4	3.9	4	12.5			4	7.6	4	10.3	4	4.0
Nov-11	30	1	4.4	1	15.3			1	9.7	1	10.5	3	3.8

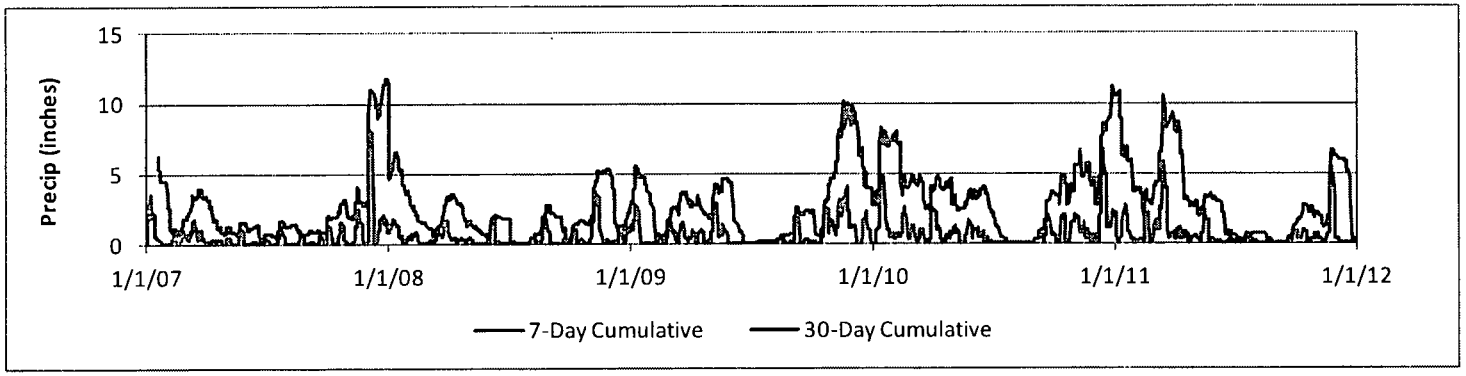
1. S&G OU, Extraction Well Operation Summary, 2007-2011

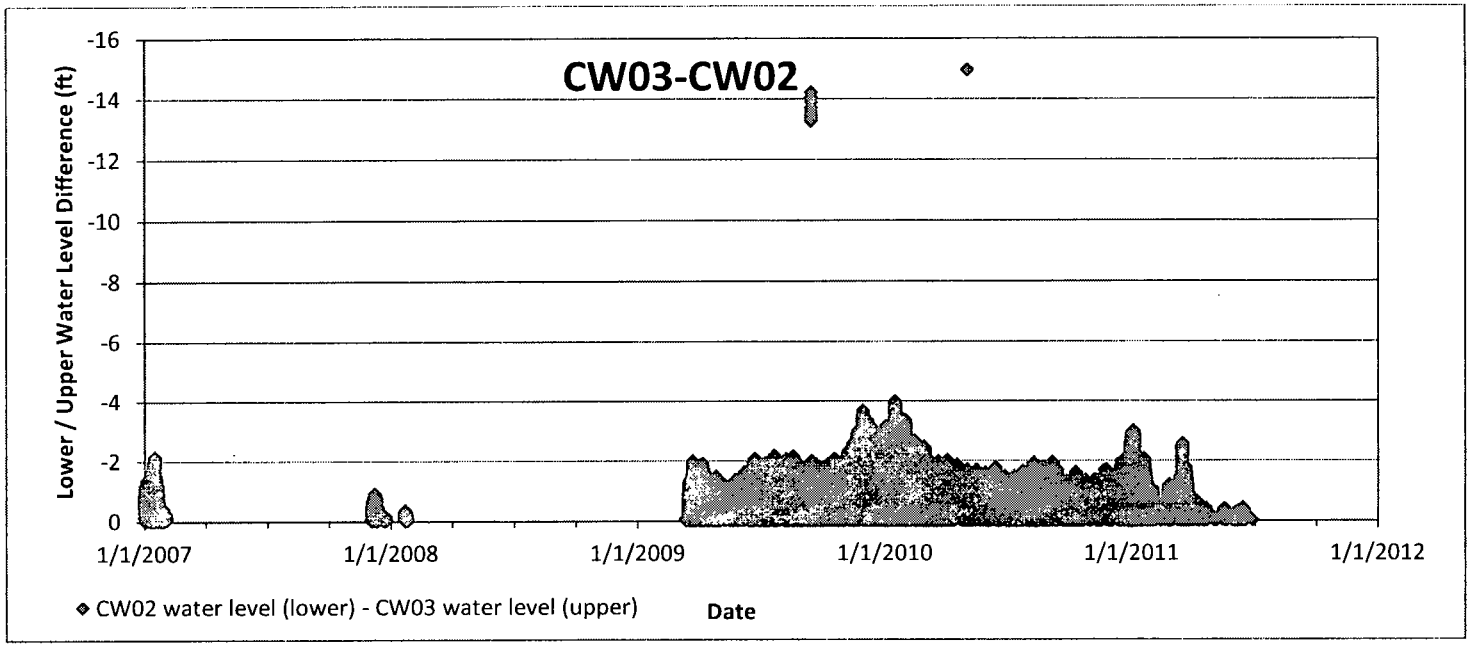
Date	Days	Extraction Well									
		7		8		9		EW-2		EW-6	
		days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)
Jan-07	31			21	1.0	7	3.1	9	4.0	31	0.0
Feb-07	28			2	5.3	7	2.8	2	3.4	7	3.0
Mar-07	31			0	6.5	31	0.0	0	2.9	1	2.6
Apr-07	30			3	4.6	30	0.0	3	2.6	3	2.5
May-07	31			0	5.2	17	1.3	0	2.9	0	2.8
Jun-07	30			0	5.2	22	0.6	0	3.0	0	2.4
Jul-07	31			0	5.2	25	0.4	13	1.8	13	1.4
Aug-07	31			0	4.8	28	0.1	0	3.2	0	1.9
Sep-07	30			0	4.7	30	0.0	24	0.5	24	0.3
Oct-07	31			0	4.1	21	0.8	31	0.0	31	0.0
Nov-07	30			0	3.6	12	1.8	30	0.0	30	0.0
Dec-07	31			0	7.2	0	4.0	10	2.3	11	1.7
Jan-08	31			9	5.5	9	3.2	31	0.0	31	0.0
Feb-08	29			0	6.7	0	3.9	29	0.0	29	0.0
Mar-08	31			0	6.1	30	0.0	31	0.0	31	0.0
Apr-08	30			0	5.4	19	1.4	30	0.0	30	0.0
May-08	31			0	5.8	24	0.7	31	0.0	31	0.0
Jun-08	30			1	5.6	30	0.0	27	0.3	27	0.2
Jul-08	31			0	5.9	31	0.0	31	0.0	31	0.0
Aug-08	31			3	5.0	26	0.6	31	0.0	31	0.0
Sep-08	30			2	4.5	30	0.0	30	0.0	30	0.0
Oct-08	31			0	5.9	31	0.0	31	0.0	31	0.0
Nov-08	30			0	6.9	6	3.4	30	0.0	30	0.0
Dec-08	31			18	2.7	18	1.6	31	0.0	31	0.0
Jan-09	31			1	6.4	1	4.3	31	0.0	31	0.0
Feb-09	28			0	5.5	12	2.1	28	0.0	28	0.0
Mar-09	31			5	4.8	23	0.9	23	1.5	23	0.7
Apr-09	30			5	2.5	7	3.0	29	0.2	7	2.1
May-09	31			0	3.6	0	3.8	31	0.0	0	2.9
Jun-09	30			26	0.7	26	0.4	30	0.0	27	0.3
Jul-09	31			31	0.0	31	0.0	31	0.0	31	0.0
Aug-09	31			30	0.0	30	0.0	31	0.0	31	0.0
Sep-09	30			21	0.8	21	1.3	30	0.0	21	0.6
Oct-09	31			22	0.9	22	1.2	0	0.0	22	0.6
Nov-09	30			11	1.8	11	2.5	30	0.0	11	1.2
Dec-09	31			15	2.4	15	2.3	17	2.3	17	0.9
Jan-10	31			11	3.3	11	3.0	11	3.1	12	0.9
Feb-10	28			8	3.8	8	3.3	8	3.9	28	0.0
Mar-10	31			8	3.8	8	3.2	8	3.6	31	0.0
Apr-10	30			8	3.6	8	3.2	8	3.5	30	0.0
May-10	31			11	3.1	11	2.6	11	3.1	0	0.0
Jun-10	30			8	3.6	11	2.5	8	3.5	30	0.0
Jul-10	31			22	1.5	26	0.7	22	1.3	31	0.0
Aug-10	31			31	0.0	31	0.0	31	0.0	31	0.0
Sep-10	30			14	2.1	14	2.2	15	2.3	23	1.6
Oct-10	31			10	3.0	10	2.5	10	2.8	10	4.1
Nov-10	30			13	3.9	18	2.3	14	3.4	14	4.6
Dec-10	31			12	4.5	31	0.0	12	4.8	12	6.4

1. S&G OU, Extraction Well Operation Summary, 2007-2011

Date	Days	Extraction Well									
		7		8		9		EW-2		EW-6	
		days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)	days down	ave flow (gpm)
Jan-11	31			8	4.0	12	2.8	8	3.1	8	4.7
Feb-11	28			5	4.3	5	3.5	5	3.9	5	5.2
Mar-11	31			2	4.8	3	3.6	1	4.3	1	5.7
Apr-11	30			0	5.3	0	4.4	0	4.8	0	6.4
May-11	31			0	5.1	0	3.9	0	4.1	0	5.9
Jun-11	30			9	3.3	3	0.4	0	3.6	0	5.1
Jul-11	31			31	0.0	27	0.5	17	1.5	17	2.0
Aug-11	31			31	0.0	31	0.0	31	0.0	31	0.0
Sep-11	30			12	3.3	13	2.0	12	2.1	12	2.9
Oct-11	31			4	6.6	21	1.3	4	3.1	4	4.2
Nov-11	30			1	9.4	13	2.3	1	2.9	6	3.3

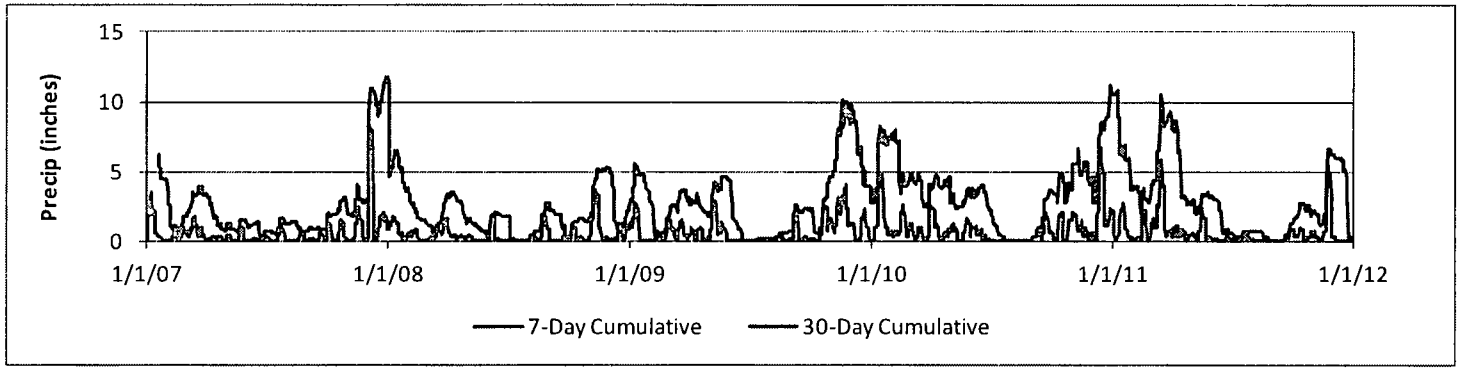
2. S&G OU, Vertical Well Pair Negative Gradients and Cumulative Precipitation, 2007-2011

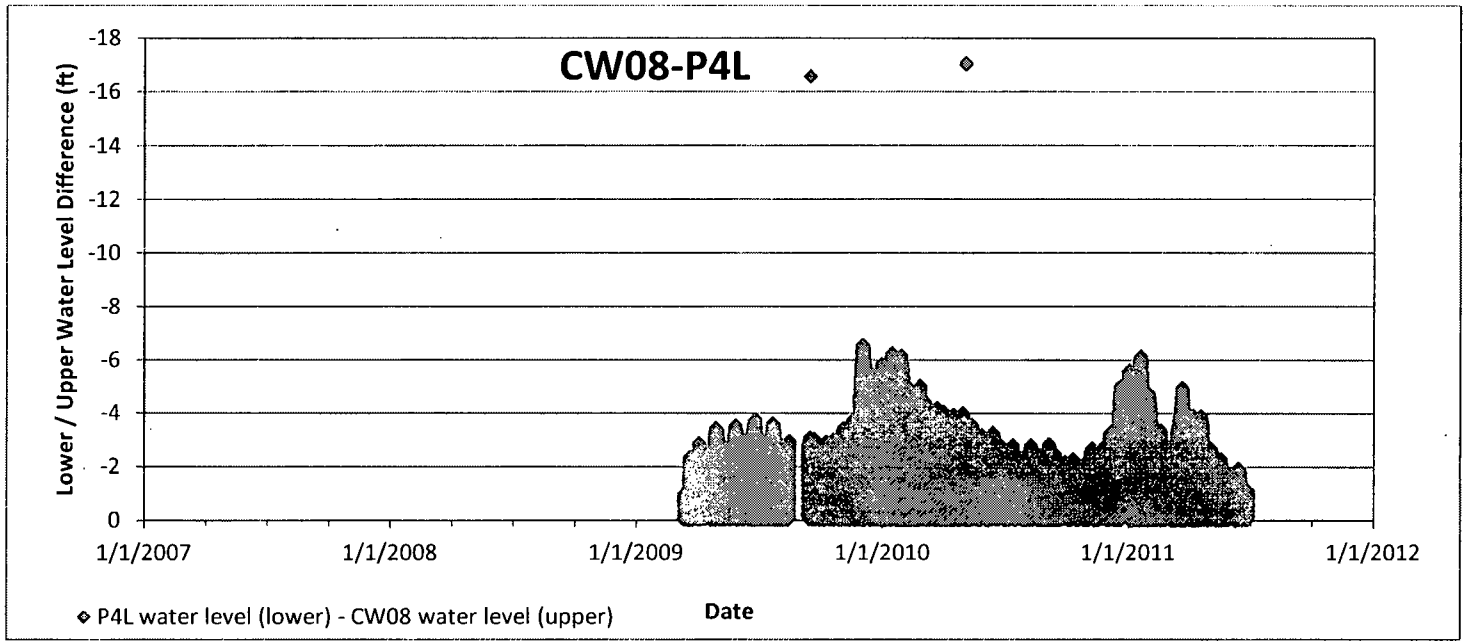




Note: A negative difference between lower and upper water levels indicates downward flow (negative gradient). Only negative gradients shown on figure.

2. S&G OU, Vertical Well Pair Negative Gradients and Cumulative Precipitation, 2007-2011





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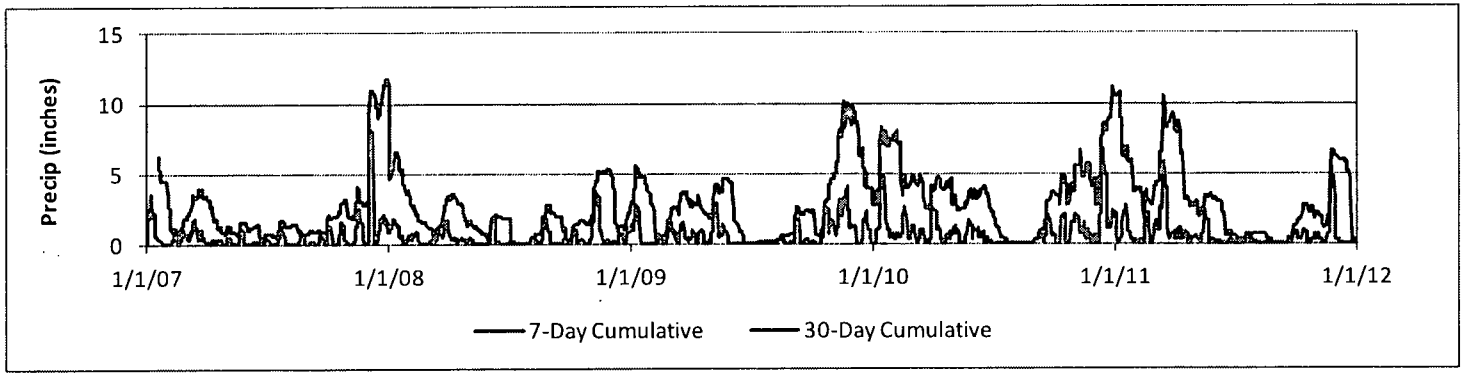

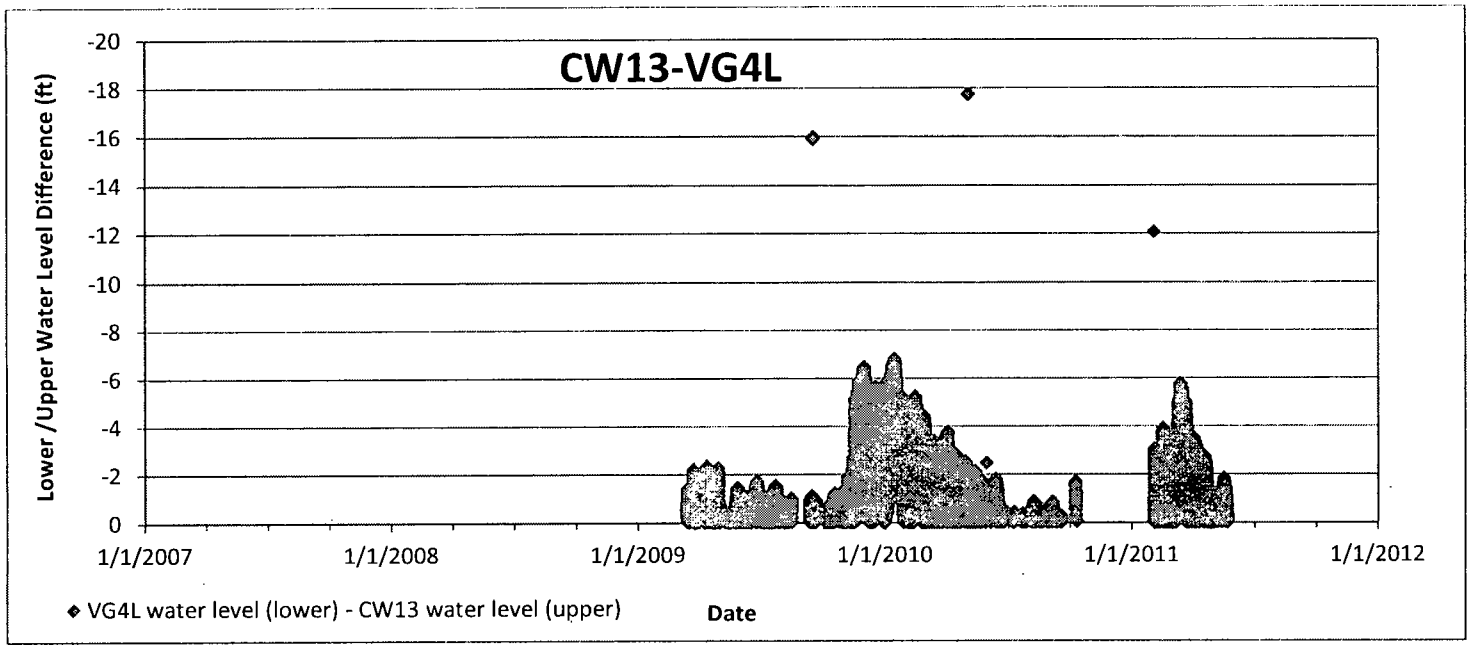

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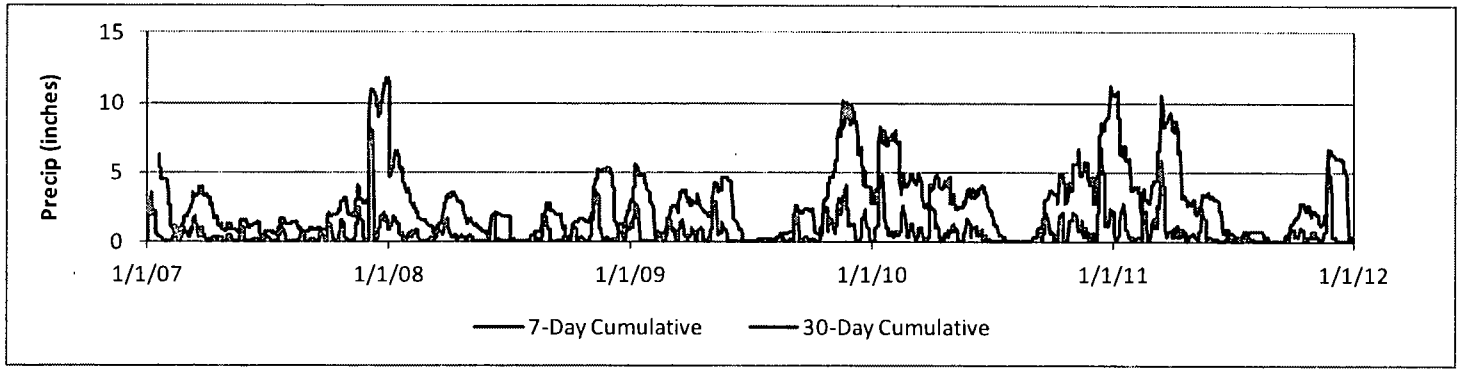

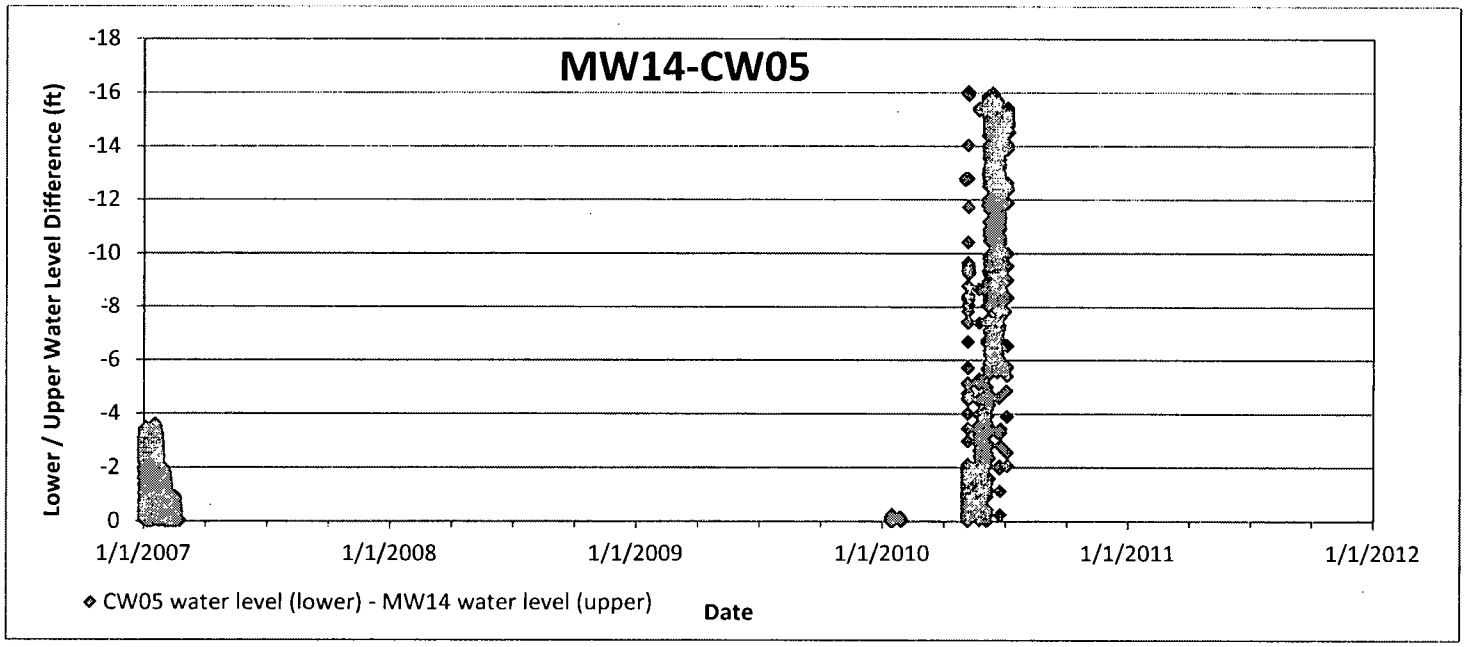

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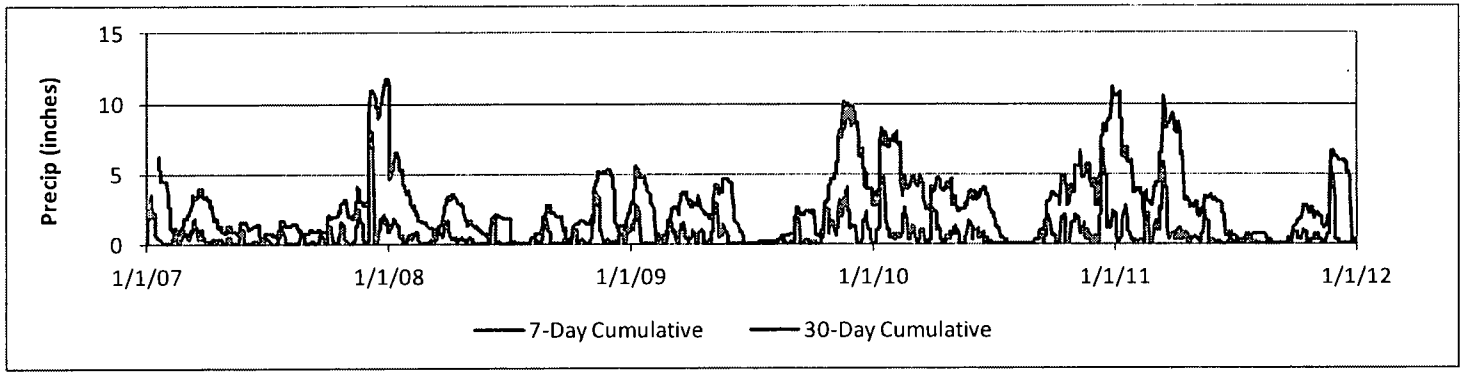

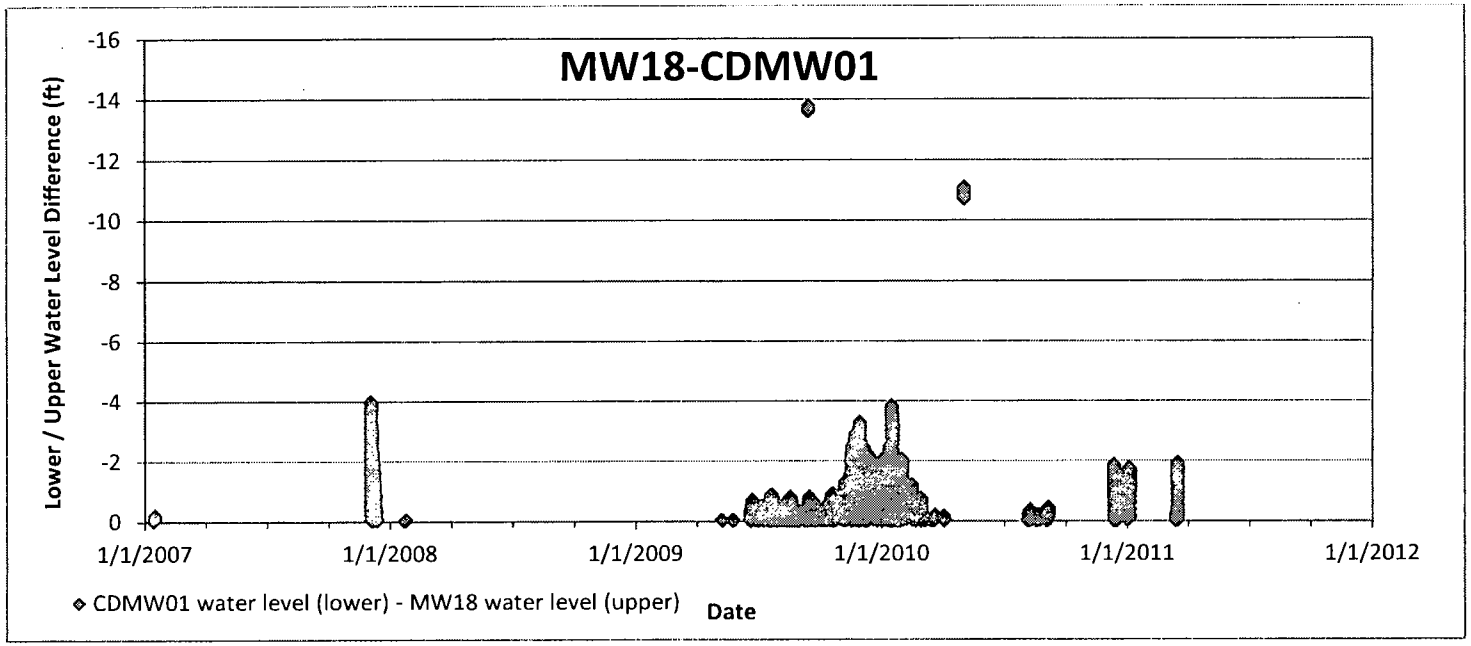

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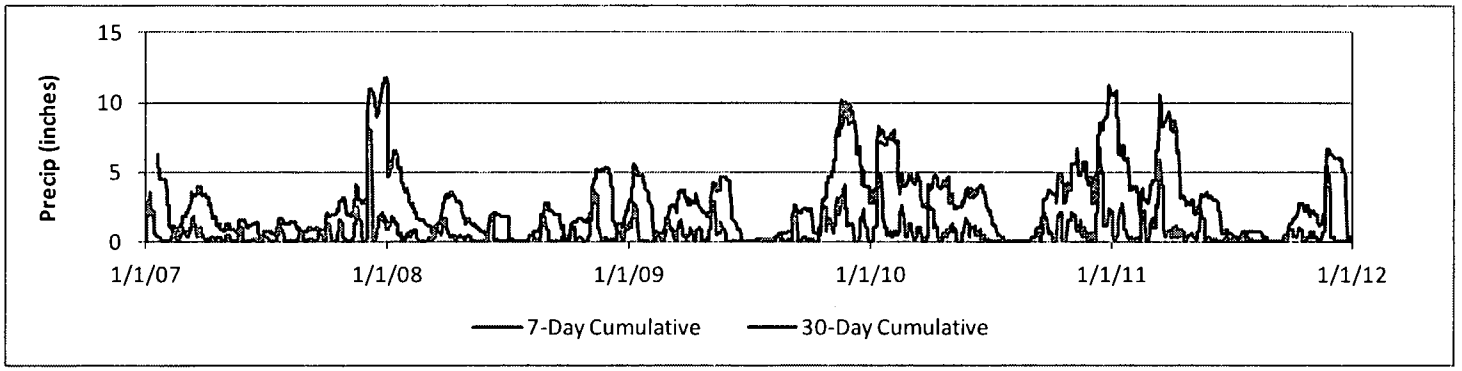

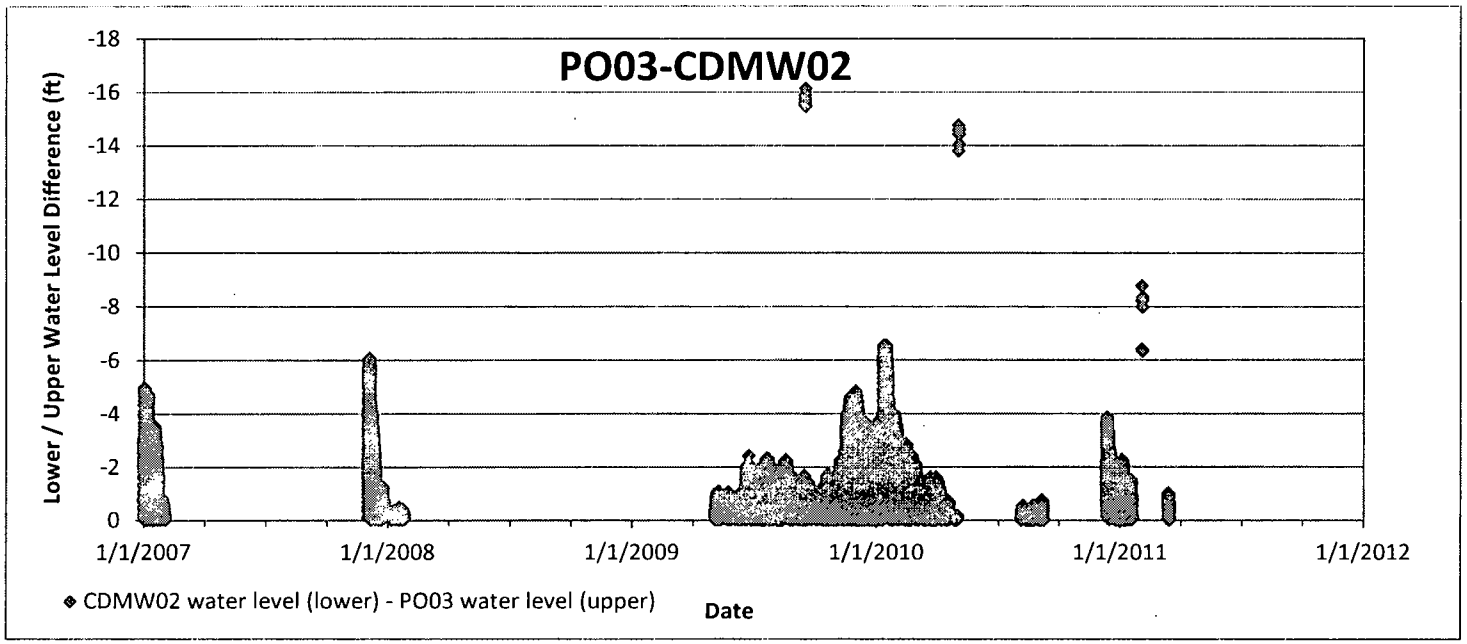

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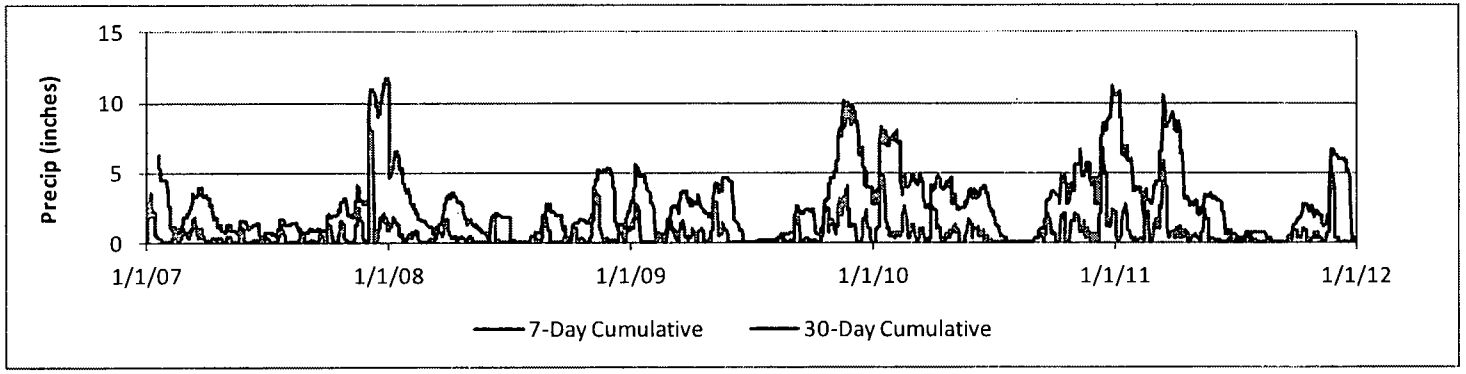

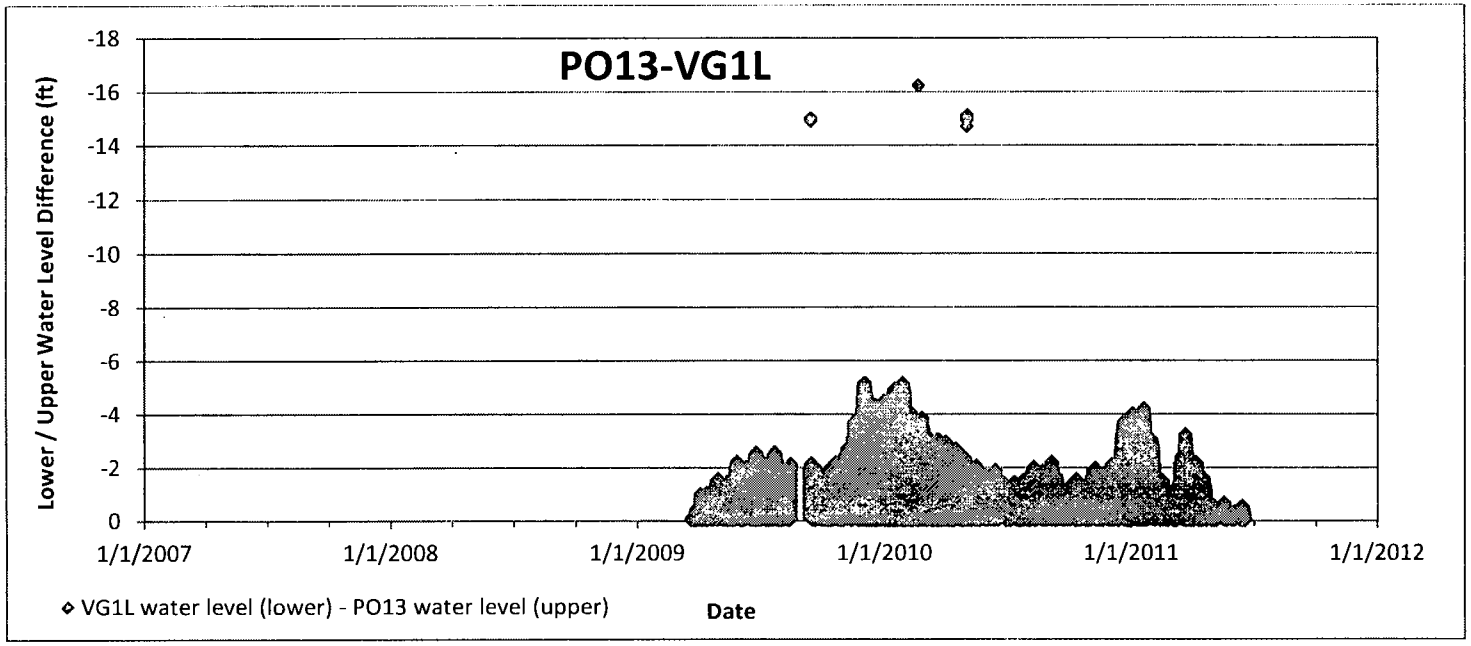

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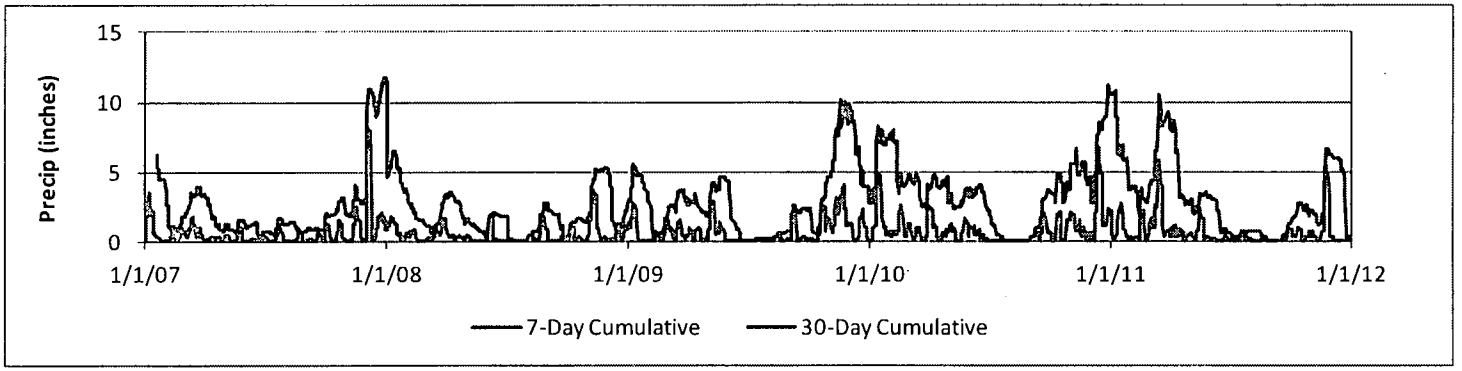

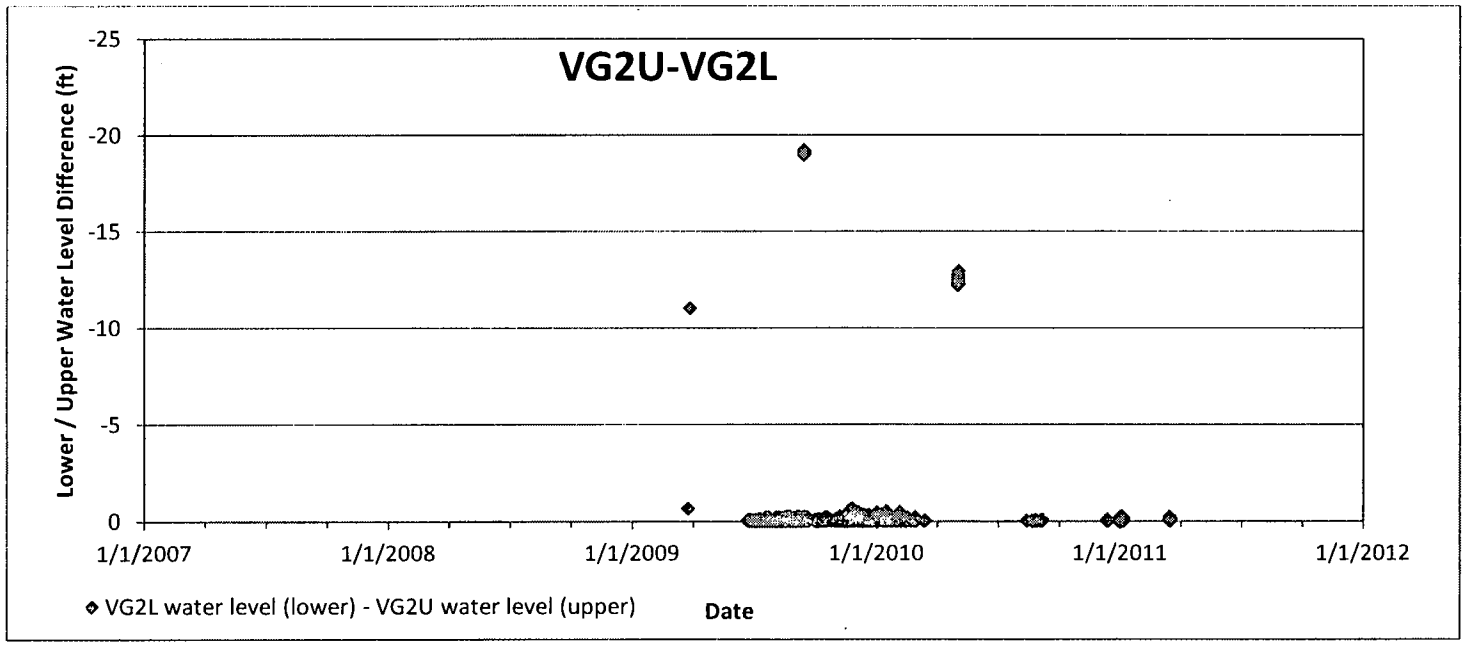

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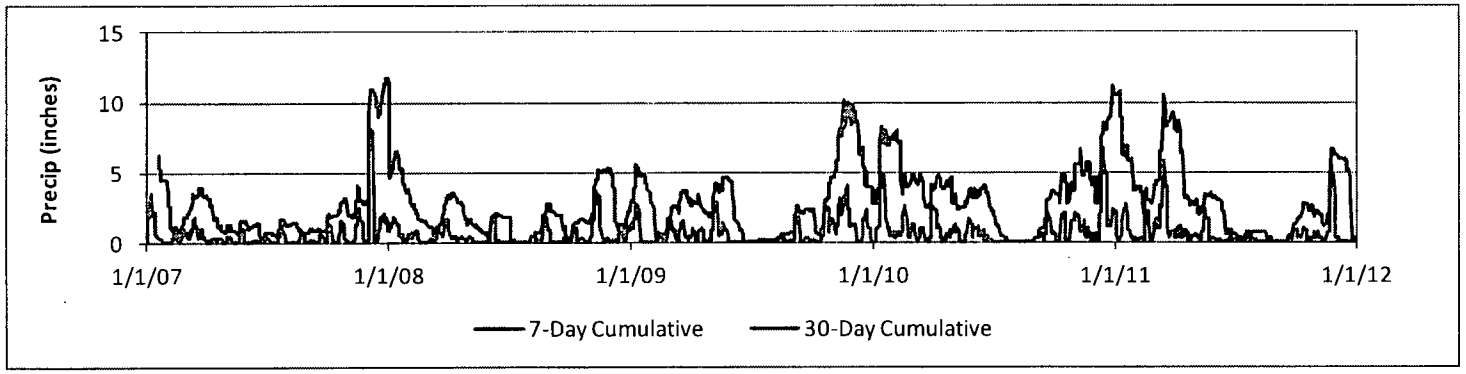

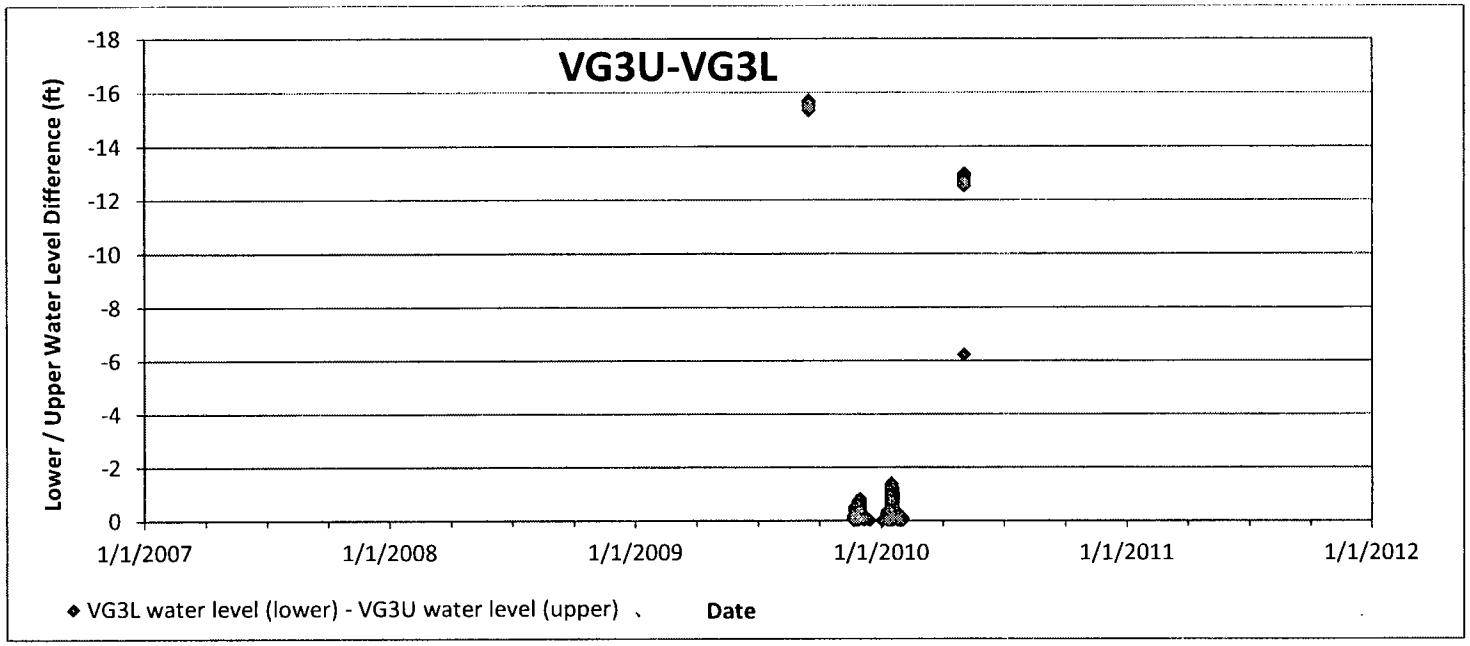

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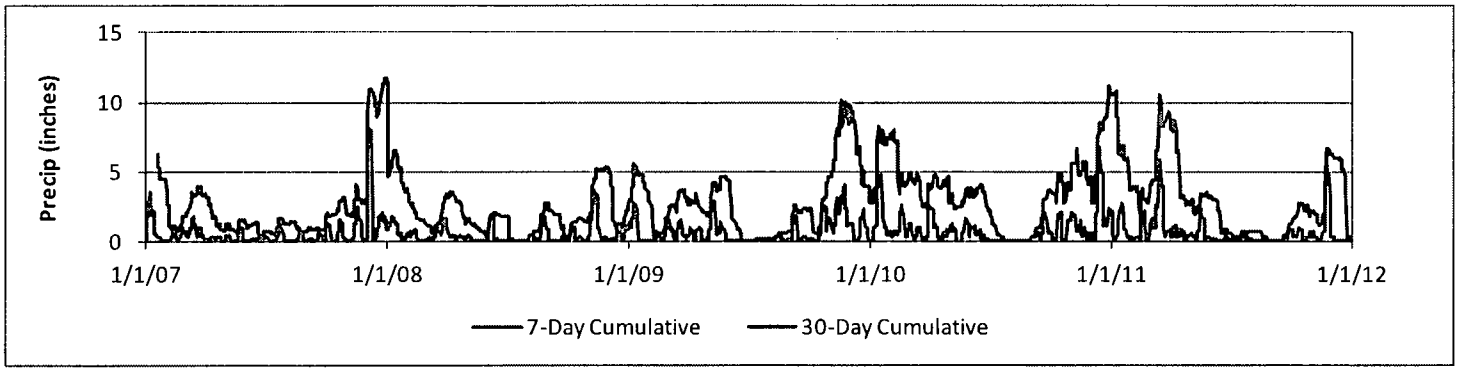

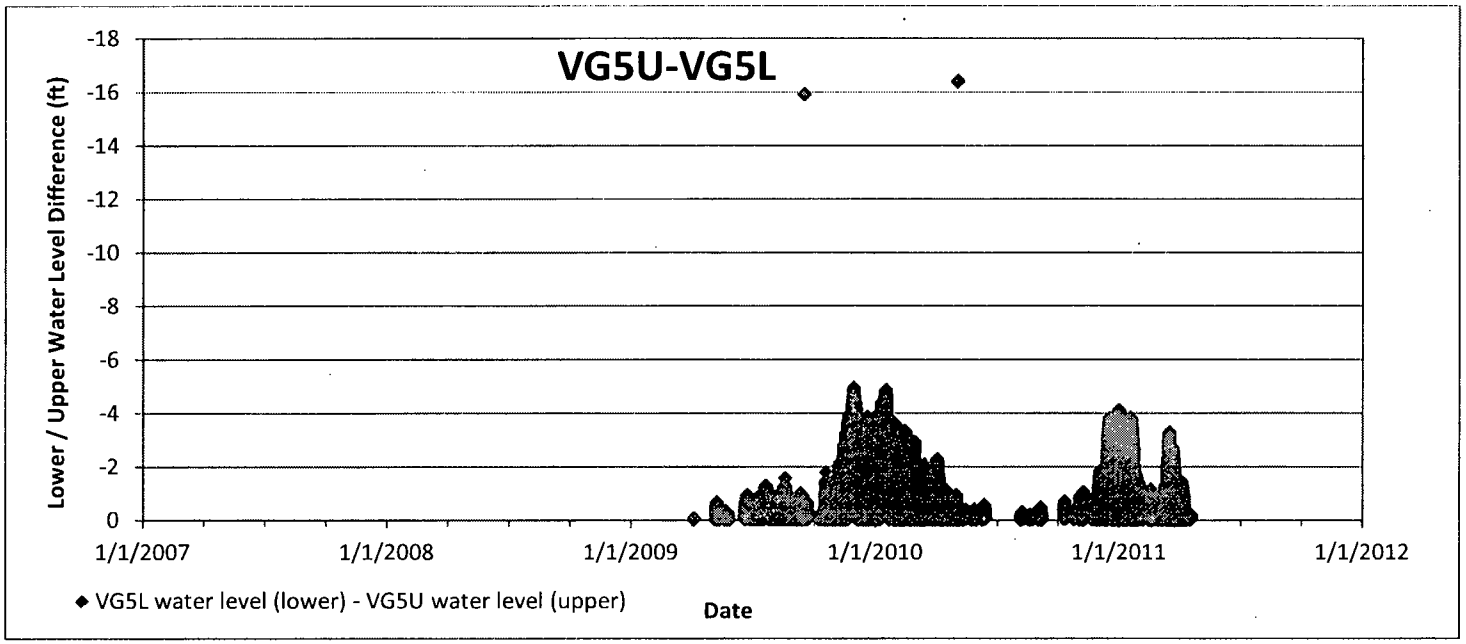

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3 S&GOU. Average gradients per monitoring period

Monitoring Period	Average Gradient/Monitoring Period									
	CW03/ CW02	CW08/ P4L	CW13/ VG4L	MW14/ CW05	MW18/ CDMW01	PO03/ CDMW02	PO13/ VG1L	VG2U/ VG2L	VG3U/ VG3L	VG5U/ VG3L
Dec 21, 2006 - Mar 31, 2007	1.78	--	--	1.59	7.28	2.48	--	--	--	--
Apr 1, 2007 - Jul 11, 2007	3.13	--	--	4.13	9.84	5.54	--	--	--	--
Jul 11, 2007 - Nov 14, 2007	3.68	--	--	5	8.16	6.25	--	--	--	--
Nov 14, 2007 - Mar 17, 2008	2.71	--	--	2.74	5.83	3.46	--	--	--	--
Apr 3, 2008 - Aug 7, 2008	na	--	--	5.04	8.93	6.42	--	--	--	--
Aug 7, 2008 - Dec 10, 2008	na	--	--	4.78	9.26	6.54	--	--	--	--
Dec 12, 2008 - Mar 12, 2009	0.54	0.76	1.01	7.65	5.78	na	1.34	1.39	4.55	2.8
Mar 12, 2009 - Jun 11, 2009	0.21	1.18	10.53	6.76	3.58	2.18	1.91	0.86	3.44	2.37
Jun 12, 2009 - Sept 11, 2009	-0.08	0.52	10.43	5.58	1.87	1.04	0.89	0.15	1.93	1.2
Sept 11, 2009 - Jan 6, 2010	-0.32	-0.32	-0.12	na	1.4	0.46	0.25	0.16	1.84	0.06
Jan 6, 2010 - Apr 5, 2010	-0.27	-1.31	-1.8	4.22	2.33	0.21	-0.33	0.47	2.15	-0.62
Apr 6, 2010 - Jul 4, 2010	0.51	0.43	0.95	na	4.25	3.15	1.35	0.93	3.61	1.74
Jul 5, 2010 - Oct 2, 2010	0.21	1.03	2.31	na	2.95	2.89	1.46	0.53	2.83	2.1
Oct 3, 2010 - Dec 31, 2010	0.48	0.81	2.85	na	4.05	3.15	1.38	0.79	3.54	0.91
Jan 1, 2011 - Mar 31, 2011	0.73	-0.67	-1.03	5.2	9.89	6.13	0.82	0.97	3.58	0.24
Apr 1, 2011 - Jun 29, 2011	1.7	1.12	1.93	5.56	7.32	12.11	2.44	1.58	5.13	3.01
Jun 30,2011 - Sept 27, 2011	1.26	1.94	2.55	5.14	3.04	1.06	2.37	0.82	3.08	2.85
Sept 28, 2011 - Dec 26, 2011	3.4	2.58	3.31	4.53	6.19	4.95	3.54	1.86	5.56	3.95

NOTES:
Positive value indicates upward gradient
Negative value indicates downward gradient
Highlight indicates containment not met at a well pair
na = not available, instrumentation errors

4. S&G OU, Groundwater Sampling Results Summary, 2007-2011

Chemical Group	Analyte	Units	Groundwater Cleanup Level (ug/L)*	CW01 (4)		CW02 (4)		CW05 (4)		CW09 (4)		CW12 (4)		CW15 (4)		02CD-MW01 (4)		99CD-MW02 (4)	
				Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
BNA	1,1'-Biphenyl	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.94 UJ	***15.3***	0.44 UJ	1 U	0.44 U	***3***	***0.8 J***	***5.2***	0.48 UJ	1 U	0.49 U	0.98 U
BNA	1,2,4,5-Tetrachlorobenzene	ug/L	--	0.48 U	0.48 U	0.45 UJ	0.45 UJ	0.47 U	0.47 U	0.44 UJ	0.44 UJ	0.44 U	0.44 U	0.5 U	0.5 U	0.48 UJ	0.48 UJ	0.49 U	0.49 U
BNA	1,2,4-Trichlorobenzene	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.47 UJ	1 U	0.44 UJ	1 U	0.44 UJ	1 U	0.5 UJ	1 UJ	0.48 UJ	1 U	0.49 UJ	0.98 UJ
BNA	1,2-Dichlorobenzene	ug/L	--	0.89 U	1 U	0.86 UJ	1 U	0.94 U	1 U	0.86 UJ	1 U	0.93 UJ	1 U	0.9 U	1 UJ	0.89 UJ	1 U	0.9 U	0.98 UJ
BNA	1,2-Diphenylhydrazine	ug/L	--	0.89 UJ	1 U	0.86 UJ	1 U	0.94 UJ	1 U	0.86 UJ	1 U	0.93 UJ	1 U	0.9 U	1 U	0.89 UJ	1 UJ	0.9 U	0.98 U
BNA	1,3-Dichlorobenzene	ug/L	--	0.89 U	1 U	0.86 UJ	1 U	0.94 U	1 U	0.86 UJ	1 U	0.93 UJ	1 U	0.9 U	1 U	0.89 UJ	1 U	0.9 U	0.98 U
BNA	1,4-Dichlorobenzene	ug/L	--	0.89 U	1 U	0.86 UJ	1 U	0.94 U	1 U	0.86 UJ	1 U	0.93 UJ	1 U	0.9 U	1 UJ	0.89 UJ	1 U	0.9 U	0.98 UJ
BNA	1-Methylnaphthalene	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.94 U	1 U	0.44 UJ	1 U	0.44 U	1 U	***12***	***36***	0.48 UJ	0.9 U	0.49 U	0.96 U
BNA	2,3,4,6-Tetrachlorophenol	ug/L	--	0.48 U	0.48 U	0.45 U	0.45 U	0.47 U	0.47 U	0.44 U	0.44 U	0.44 U	0.44 U	0.5 U	0.5 U	0.48 U	0.48 U	0.49 U	0.49 U
BNA	2,4,5-Trichlorophenol	ug/L	--	0.48 UJ	1.9 UJ	0.45 UJ	2 UJ	***0.65 J***	2 U	0.44 UJ	2.1 UJ	0.44 UJ	2 UJ	0.5 UJ	2 U	0.48 UJ	2 UJ	0.49 UJ	2 U
BNA	2,4,6-Trichlorophenol	ug/L	--	0.48 UJ	1.9 U	0.45 UJ	2 UJ	***0.62 J***	2 U	0.44 UJ	2.1 UJ	0.44 UJ	2 U	0.5 UJ	2 UJ	0.48 UJ	2 UJ	0.49 UJ	2 U
BNA	2,4-Dichlorophenol	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.47 U	1 U	0.44 UJ	1 U	0.44 U	1 U	0.48 U	1 U	0.48 UJ	1 UJ	0.49 U	0.98 U
BNA	2,4-Dimethylphenol	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.47 UJ	1 U	0.44 UJ	1 U	0.44 UJ	1 U	0.5 UJ	1 UJ	0.48 UJ	1 UJ	0.49 UJ	0.98 U
BNA	2,4-Dinitrophenol	ug/L	--	0.48 UJ	10 U	0.45 UJ	10 U	0.47 U	10 U	0.44 UJ	10 U	0.44 UJ	10 U	0.5 UJ	9 U	0.48 UJ	9.3 U	0.49 UJ	9.4 U
BNA	2,4-Dinitrotoluene	ug/L	--	0.48 U	1 U	0.45 U	1 U	0.47 U	1 U	0.44 U	1 U	0.44 U	1 U	0.5 U	1 U	0.48 U	1 UJ	0.49 U	0.98 U
BNA	2,6-Dinitrotoluene	ug/L	--	0.89 U	2 U	0.86 UJ	2 U	0.94 U	2 U	0.86 UJ	2.1 U	0.88 U	2 U	0.94 U	2 U	0.89 UJ	2 U	0.96 U	2 U
BNA	2-Chloronaphthalene	ug/L	--	0.48 U	4 U	0.45 UJ	4 U	0.47 U	4 U	0.44 UJ	4 U	0.44 U	4 U	0.5 U	4 U	0.48 UJ	4 U	0.49 U	4 U
BNA	2-Chlorophenol	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.47 U	1 U	0.44 UJ	1 U	0.44 U	1 U	0.5 U	1 U	0.48 UJ	1 UJ	0.49 U	0.98 U
BNA	2-Methylnaphthalene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	2-Methylphenol	ug/L	--	0.48 U	1.8 U	0.45 UJ	1.7 UJ	0.47 U	1.9 U	0.44 UJ	1 U	0.44 U	1.9 UJ	0.5 U	1.9 U	0.48 UJ	1.78 UJ	0.49 U	1.9 U
BNA	2-Nitroaniline	ug/L	--	0.48 U	1 U	0.45 U	1 U	0.47 U	1 U	0.44 U	1 U	0.44 U	1 U	0.5 U	1 U	0.48 U	1 UJ	0.49 U	0.98 U
BNA	2-Nitrophenol	ug/L	--	0.48 U	1.9 U	0.45 UJ	2 U	0.47 U	2 U	0.44 UJ	2.1 U	0.44 U	2 U	0.5 U	1 U	0.48 UJ	2 U	0.49 U	2 U
BNA	3,3'-Dichlorobenzidine	ug/L	--	0.48 U	15 UJ	0.45 U	1 U	0.47 UJ	16 UJ	0.44 U	1 U	0.44 UJ	16 UJ	0.5 UJ	16 UJ	0.48 U	0.9 U	0.49 UJ	16 UJ
BNA	3-Nitroaniline	ug/L	--	0.48 U	1 U	0.45 U	1 U	0.47 U	1 U	0.44 U	1 U	0.44 U	1 U	0.5 UJ	1 UJ	0.48 U	1 UJ	0.49 U	0.98 U
BNA	4,6-Dinitro-2-methylphenol	ug/L	--	0.89 U	4 U	0.86 UJ	4 U	0.94 U	4 U	0.86 UJ	4 U	0.88 U	4 U	0.94 U	4 U	0.89 UJ	4 U	0.96 U	4 U
BNA	4-Bromophenyl-phenylether	ug/L	--	0.48 U	1 U	0.45 U	1 U	0.47 U	1 U	0.44 U	1 U	0.44 U	1 U	0.5 U	1 U	0.48 U	1 U	0.49 U	0.98 U
BNA	4-Chloro-3-methylphenol	ug/L	--	0.48 U	1.9 U	0.45 UJ	2 UJ	0.47 U	2 U	0.44 UJ	2.1 UJ	0.44 U	2 U	0.5 U	2 UJ	0.48 UJ	2 UJ	0.49 U	2 U
BNA	4-Chloroaniline	ug/L	--	0.48 UJ	19 UJ	0.45 UJ	2 U	0.47 UJ	20 UJ	0.44 UJ	2 U	0.44 UJ	20 UJ	0.5 UJ	20 UJ	0.48 UJ	2 U	0.49 UJ	20 UJ
BNA	4-Chlorophenyl-phenylether	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.47 U	1 U	0.44 UJ	1 U	0.44 U	1 U	0.5 U	1 U	0.48 UJ	1 U	0.49 U	0.98 U
BNA	4-Methylphenol	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.47 U	1 U	0.44 UJ	1 U	0.44 U	1 U	0.5 U	1 U	0.48 UJ	1 U	0.49 U	0.98 U
BNA	4-Nitroaniline	ug/L	--	0.48 U	3.8 UJ	0.45 U	3.9 UJ	0.47 U	4 U	0.44 U	4.2 UJ	0.44 U	3.9 UJ	0.5 U	4 U	0.48 U	4.1 UJ	0.49 U	3.9 U
BNA	4-Nitrophenol	ug/L	--	0.48 UJ	19 U	0.45 UJ	20 UJ	0.47 UJ	20 U	0.44 UJ	21 UJ	0.44 UJ	20 U	0.5 UJ	4 U	0.48 UJ	20 UJ	0.49 UJ	20 U
BNA	9H-Carbazole	ug/L	--	0.48 U	4 U	0.45 U	4 U	0.94 U	45	0.44 U	4 U	0.44 U	4 U	***3***	***17***	0.48 U	4 U	0.49 U	4 U
BNA	Acenaphthene	ug/L	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Acenaphthylene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Acetophenone	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Anthracene	ug/L	9.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Atrazine	ug/L	--	0.48 U	1 U	0.45 U	1 U	0.47 U	1 U	0.44 U	1 U	0.44 U	1 U	0.5 U	1 U	0.48 U	1 UJ	0.49 U	0.98 U
BNA	Benzaldehyde	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.47 UJ	1 U	***0.23 J***	1 U	0.44 UJ	1 U	0.5 UJ	1 U	0.48 UJ	1 U	0.49 UJ	0.98 U
BNA	Benzenemethanol	ug/L	--	1.8 UJ	2 U	1.7 UJ	2 U	1.9 UJ	2 U	0.86 UJ	2 U	1.9 UJ	2 U	1.9 UJ	2 U	1.78 UJ	1.9 U	1.9 UJ	2 U
BNA	Benzo(a)anthracene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(a)pyrene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(b)fluoranthene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(g,h,i)perylene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(k)fluoranthene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzoic acid	ug/L	--	2.8 U	7.5 UJ	2.3 UJ	7.8 UJ	3.1 U	8 UJ	2.5 UJ	8.3 UJ	2.9 UJ	7.8 UJ	4 UJ	8 UJ	0.89 UJ	8.2 UJ	1 U	7.8 UJ
BNA	bis(2-Chloroethoxy)methane	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.47 U	1 U	0.44 UJ	1 U	0.44 U	1 U	0.5 U	1 U	0.48 UJ	1 U	0.49 U	0.98 U
BNA	bis(2-Chloroethyl)ether	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.47 U	1 U	0.44 UJ	1 U	0.44 U	1 U	0.5 U	1 U	0.48 UJ	1 U	0.49 U	0.98 U
BNA	bis(2-chloroisopropyl)ether	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.47 UJ	1 U	0.44 UJ	1 U	0.44 UJ	1 U	0.5 UJ	1 U	0.48 UJ	1 U	0.49 UJ	0.98 U
BNA	bis(2-ethylhexyl)phthalate	ug/L	--	0.48 U	1.9 U	0.45 U	2.4 UJ	0.47 U	2 U	0.44 U	2.1 U	0.44 U	***4.8***	0.5 U	2 U	0.48 U	2.1 UJ	0.49 U	2 U
BNA	Butylbenzylphthalate	ug/L	--	0.48 U	1 U	0.45 U	1 U	0.47 U	1 U	0.44 U	1 U	0.44 U	1 U	0.5 U	1 U	0.48 U	1 U	0.49 U	0.98 U
BNA	Caffeine	ug/L	--	0.48 UJ	1 U	0.45 U	1 U	0.47 UJ	1 U	0.44 U	1 U	0.44 UJ	1 U	0.5 UJ	0.9 U	0.48 U	0.9 U	0.49 UJ	0.9 U
BNA	Caprolactam	ug/L	--	0.48 UJ	19 U	0.45 UJ	20 U	0.47 UJ	20 U	0.44 UJ	21 U	0.44 UJ	20 U	0.5 UJ	20 UJ	0.48 UJ	20 U	0.49 UJ	20 U
BNA	Chrysene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Dibenzo(a,h)anthracene	ug/L	0.0070	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Dibenzofuran	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.94 U	***29 J***	0.44 UJ	1 U	0.44 U	***8.7***	***24***	***30***	0.48 UJ	1 U	0.49 U	0.98 U
BNA	Diethylphthalate	ug/L	--	***0.3 J***	1.9 U	0.45 U	2 UJ	0.47 U	2 U	0.44 U	2.1 UJ	0.44 U	2 U	0.5 U	2 U	0.48 U	2 UJ	0.49 U	2 U
BNA	Dimethylphthalate	ug/L	--	***0.4 J***	0.94 U	0.45 U	1 U	0.47 UJ	1 U	0.44 U	1 U	0.44 UJ	1 U	0.5 UJ	1 U	0.48 U	1 UJ	0.49 UJ	0.98 U
BNA	Di-n-butylphthalate	ug/L	--	0.48 U	1.9 U	0.45 U	2 UJ	0.47 U	2 U	0.86 UJ	***4.7***	0.44 U	2 U	0.5 U	2 U	0.48 U	2 UJ	0.49 U	2 U
BNA	Di-n-octylphthalate	ug/L	--	0.48 U	1.9 U	0.45 U	2 U	0.47 U	2 U	0.44 U	2.1 U	0.44 U	2 U	0.5 U	2 U	0.48 U	2 U	0.49 U	2 U
BNA	Ethanone, 1-phenyl-	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.47 U	1 U	0.44 UJ	1 U	0.44 U	1 U	0.5 U	1 U	0.48 UJ	1 U	0.49 U	0.98 U
BNA	Fluoranthene	ug/L	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Fluorene	ug/L	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Hexachlorobenzene	ug/L	--	0.48 U	1 U	0.45 U	1 U	0.47 U	1 U	0.44 U	1 U	0.44 U	1 U	0.5 U	1 U	0.48 U	1 U	0.49 U	0.98 U
BNA	Hexachlorobutadiene	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.47 UJ	1 U	0.44 UJ	1 U	0.44 UJ	1 U	0.5 UJ	1 UJ	0.48 UJ	1 U	0.49 UJ	0.98 U
BNA	Hexachlorocyclopentadiene	ug/L	--	0.48 UJ	2 U	0.45 UJ	2 U	0.47 UJ	2 U	0.44 UJ	2.1 U	0.44 UJ	2 U	0.5 UJ	2 U	0.48 UJ	2 U	0.49 UJ	2 U
BNA	Hexachloroethane	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.47 UJ	1 U	0.44 UJ	1 U	0.44 UJ	1 U	0.5 UJ	1 U	0.48 UJ	1 U	0.49 UJ	0.98 U
BNA	Indeno(1,2,3-cd)pyrene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

4. S&G OU, Groundwater Sampling Results Summary, 2007-2011

Chemical Group	Analyte	Units	Groundwater Cleanup Level (ug/L)*	CW01 (4)		CW02 (4)		CW05 (4)		CW09 (4)		CW12 (4)		CW15 (4)		02CD-MW01 (4)		99CD-MW02 (4)	
				Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
BNA	Isophorone	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.47 U	1 U	0.44 UJ	1 U	0.44 U	1 U	0.5 U	1 U	0.48 UJ	1 U	0.49 U	0.98 U
BNA	Naphthalene	ug/L	83	0.94 U	0.94 U	0.98 U	0.98 U	1 U	1 U	1 U	1 U	0.98 U	0.98 U	1 U	***265***	1 U	1 U	0.98 U	0.98 U
BNA	Nitrobenzene	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.47 U	1 U	0.44 UJ	1 U	0.44 U	1 U	0.5 U	0.94 U	0.48 UJ	0.9 U	0.49 U	0.96 U
BNA	n-Nitrosodimethylamine	ug/L	--	0.94 U	0.94 U	0.98 U	0.98 U	1 U	1 U	1 U	1 U	0.98 U	0.98 U	1 U	1 U	1 U	1 U	0.98 U	0.98 U
BNA	n-Nitrosodinpropylamine	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.47 U	1 U	0.44 UJ	1 U	0.44 U	1 U	0.5 U	1 U	0.48 UJ	1 UJ	0.49 U	0.98 U
BNA	n-Nitrosodiphenylamine	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.47 UJ	1 U	0.44 UJ	1 U	0.44 UJ	1 U	0.5 UJ	0.94 UJ	0.48 UJ	0.9 U	0.49 UJ	0.96 UJ
BNA	Pentachlorophenol	ug/L	4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Phenanthrene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Phenol	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.47 U	1 U	0.44 UJ	1 U	0.44 U	1 U	0.5 U	1 U	0.48 UJ	1 U	0.49 U	0.98 U
BNA	Pyrene	ug/L	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Retene	ug/L	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U
General	Dissolved Oxygen	mg/L	--	***7.68***	***9.26***	--	***5.38***	--	***4.39***	--	***5.22***	***1.61***	***8.09***	--	***4.37***	***0***	***4.17***	***2.8***	***5.97***
General	Eh	mV	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General	Oxidization Reduction Potential	mV	--	***54***	***218***	***40***	***130***	***-38***	***-26***	***-48***	***-29***	***-4***	***160***	***-286***	***-109***	***-105***	***39***	***-161***	***53***
General	pH	units	--	***6.8***	***7.56***	***6.81***	***7.35***	***7.15***	***7.33***	***6.86***	***7.16***	***6.81***	***8.75***	***6.73***	***6.98***	***7.6***	***9.03***	***7.75***	***8.24***
General	Salinity	%	--	--	***0.01***	***0.07***	***0.13***	***1.52***	***2.6***	***1.1***	***2***	--	***0.01***	***0.59***	***1.7***	--	***0.01***	--	***0.01***
General	Specific Conductivity	mS	--	***0.313***	***0.37***	***1.34***	***2.79***	***25.1***	***40.7***	***19.6***	***31.9***	***0.286***	***0.33***	***9.99***	***28.7***	***0.269***	***3***	***0.244***	***0.331***
General	Temperature	°C	--	***10.7***	***14.7***	***11.74***	***14.14***	***11.5***	***14.9***	***11.2***	***13.97***	***12.1***	***14.92***	***11.3***	***14.6***	***13.16***	***15.97***	***11.7***	***15.2***
General	Turbidity	ntu	--	***23.9***	***206***	--	***88***	***0***	***15.5***	***0***	***28.5***	***11.2***	***31.8***	--	***90.3***	***9.7***	***35.3***	***10***	***50.7***
PAH	1-Methylnaphthalene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PAH	2-Chloronaphthalene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PAH	2-Methylnaphthalene	ug/L	--	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	***220***	0.029 U	0.031 U	0.029 U	***3.5***	0.029 U	***12***	0.029 U	0.03 U	0.029 U	***0.048***
PAH	Acenaphthene	ug/L	3.0	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	***74***	0.029 U	***0.1***	0.029 U	***19***	***60***	***170***	0.029 U	0.03 U	0.029 U	0.029 U
PAH	Acenaphthylene	ug/L	--	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	***1.6***	0.029 U	0.031 U	0.031 U	***0.61***	***0.37***	***1.8***	0.029 U	0.03 U	0.029 U	0.029 U
PAH	Anthracene	ug/L	9	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	***2.9***	***0.029 J***	0.031 U	***0.039***	***2.7***	***1.4***	***2.7***	0.029 U	***0.24***	0.029 U	0.029 U
PAH	Benzo(a)anthracene	ug/L	0.030	0.029 U	0.03 U	0.029 U	0.03 U	***0.11***	***0.43 J***	0.029 U	0.031 U	0.029 U	***0.48***	***0.14***	***0.31 J***	0.029 U	0.03 U	0.029 U	0.029 U
PAH	Benzo(a)pyrene	ug/L	0.030	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	***0.043 J***	0.029 U	0.031 U	0.029 U	***0.11***	0.029 U	0.031 U	0.029 U	0.03 U	0.029 U	0.029 U
PAH	Benzo(b)fluoranthene	ug/L	0.030	0.029 U	0.03 U	0.029 U	0.03 U	***0.034***	***0.099 J***	0.029 U	0.031 U	0.031 U	***0.21***	***0.048***	***0.09 J***	0.029 U	0.03 U	0.029 U	0.029 U
PAH	Benzo(g,h,i)perylene	ug/L	--	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	***0.037***	0.029 UJ	0.031 UJ	0.029 U	0.03 U	0.029 U	0.029 U
PAH	Benzo(k)fluoranthene	ug/L	0.030	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	***0.079***	***0.024 J***	0.031 U	0.029 U	0.03 U	0.029 U	0.029 U
PAH	Chrysene	ug/L	0.030	0.029 U	0.03 U	0.029 U	0.03 U	***0.071***	***0.12***	0.029 U	0.031 U	0.031 U	***0.48***	***0.12***	***0.14***	0.029 U	0.03 U	0.029 U	0.029 U
PAH	Dibenzo(a,h)anthracene	ug/L	0.0070	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.03 U	0.029 U	0.029 U
PAH	Fluoranthene	ug/L	3.0	0.029 U	0.03 U	0.029 U	0.03 U	***0.9***	***2.6***	0.029 U	***0.081***	0.031 U	***6.3***	***2.3***	***3.9***	0.029 U	0.03 U	0.029 U	***0.064***
PAH	Fluorene	ug/L	3.0	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	***28***	0.029 U	0.031 U	0.031 U	***15***	***0.13***	***36***	0.029 U	0.03 U	0.029 U	0.029 U
PAH	HPAH	ug/L	0.25	0.029 U	0.03 U	0.029 U	0.03 U	***1.676***	***4.859***	0.029 U	***0.117***	0.031 U	***11.026***	***3.738***	***6.42***	0.029 U	0.03 U	0.029 U	***0.107***
PAH	Indeno(1,2,3-cd)pyrene	ug/L	0.0296	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.03 U	0.029 U	0.029 U
PAH	Naphthalene	ug/L	83	0.029 U	0.03 U	0.029 U	***0.06***	0.029 U	***3600***	0.029 U	***0.073***	0.029 U	***19***	***0.5***	***340***	0.029 U	***0.081***	0.029 U	***0.61***
PAH	Phenanthrene	ug/L	--	0.029 U	0.03 U	0.029 U	0.03 U	0.029 U	***19***	0.029 U	***0.063***	0.031 U	***29***	***6.8***	***37***	0.029 U	0.03 U	0.029 U	0.029 U
PAH	Pyrene	ug/L	15	0.029 U	0.03 U	0.029 U	0.03 U	***0.56***	***1.6***	0.029 U	***0.036***	0.031 U	***3.3***	***1.1***	***2***	0.029 U	0.03 U	0.029 U	***0.043***
PCP	Pentachlorophenol	ug/L	4.9	0.074 U	0.077 U	0.074 U	0.077 U	0.074 U	***80***	0.074 U	0.078 U	0.075 U	***0.086***	0.074 U	***0.31***	0.074 U	0.077 U	***0.16***	***1.1***
TPH	Diesel (#2)	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Lube Oil	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	TPH-GC/Diesel Range Organics	ug/L	--	93 U	190 U	93 U	190 U	93 U	***7000***	93 U	190 U	94 U	190 U	***500***	***2100***	93 U	190 U	93 U	190 U
TPH	TPH-GC/Motor Oil Range Organic	ug/L	--	190 U	460 U	190 U	460 U	190 U	480 U	190 U	460 U	190 U	480 U	190 U	460 U	190 U	460 U	190 U	460 U

NOTES:

CW01 (4) = Monitoring Well Name. Number of sampling events in parentheses.

BNA = base/neutral and acid extractables

General = general chemistry

HPAH = High molecular weight Polynuclear Aromatic Hydrocarbon compounds

PAH = polynuclear aromatic hydrocarbons

TPH = total petroleum hydrocarbons

* From Wyckoff ROD 2/2000

U Upper Aquifer Well

Bold and italics = Detected value

Reporting limit for non-detect value exceeds Groundwater Cleanup Level

Detected value exceeds Groundwater Cleanup Level

4. S&G OU, Groundwater Sampling Results Summary, 2007-2011

Chemical Group	Analyte	Units	Groundwater Cleanup Level (ug/L)*	99CD-MW04 (4)		SE-02 (3)		PZ3 (4)		PZ-05 (1)	PZ-08 (1)	PZ-09 (4)		PZ-10 (1)	PZ-11 (3)		PZ-12 (2)		P-1L (3)	
				Min	Max	Min	Max	Min	Max			Min	Max		Min	Max	Min	Max	Min	Max
BNA	1,1'-Biphenyl	ug/L	--	0.48 U	1 U	0.45 U	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	***1.2***	***12***	1 U	1 U	0.48 UJ	1 U
BNA	1,2,4,5-Tetrachlorobenzene	ug/L	--	0.48 U	0.48 U	0.45 UJ	0.45 UJ	0.48 UJ	0.48 UJ	--	--	0.48 U	0.48 U	--	0.49 U	0.49 U	--	--	0.48 UJ	0.48 UJ
BNA	1,2,4-Trichlorobenzene	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.48 UJ	1 U	1 U	1 U	0.48 UJ	1 U	0.9 U	0.49 UJ	1 U	1 U	1 U	0.48 UJ	1 U
BNA	1,2-Dichlorobenzene	ug/L	--	0.94 U	1 U	0.86 U	1 U	0.98 U	1 U	1 U	1 U	0.96 U	1 U	0.9 U	0.94 U	1 U	1 U	1 U	0.85 U	1 U
BNA	1,2-Diphenylhydrazine	ug/L	--	0.94 UJ	1 U	0.86 UJ	1 UJ	0.98 U	1 U	1 U	1 U	0.96 UJ	1 U	0.9 U	0.94 UJ	1 U	1 U	1 U	0.85 U	1 UJ
BNA	1,3-Dichlorobenzene	ug/L	--	0.94 U	1 U	0.86 U	1 U	0.98 U	1 U	1 U	1 U	0.96 U	1 U	0.9 U	0.94 U	1 U	1 U	1 U	0.85 U	1 U
BNA	1,4-Dichlorobenzene	ug/L	--	0.94 U	1 U	0.86 U	1 U	0.98 U	1 U	1 U	1 U	0.96 U	1 U	0.9 U	0.94 U	1 U	1 U	1 U	0.85 U	1 U
BNA	1-Methylnaphthalene	ug/L	--	0.48 U	1 U	0.45 UJ	0.86 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	1.9	12	1 U	1 U	0.48 UJ	0.85 U
BNA	2,3,4,6-Tetrachlorophenol	ug/L	--	0.48 U	0.48 U	0.45 U	0.45 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.49 U	0.49 U	--	--	0.48 U	0.48 U
BNA	2,4,5-Trichlorophenol	ug/L	--	0.48 UJ	2 UJ	0.45 UJ	2 UJ	0.48 UJ	2 U	1 U	1 U	0.48 UJ	2.1 U	0.9 U	0.49 U	1 U	1 U	2 UJ	0.48 UJ	2 UJ
BNA	2,4,6-Trichlorophenol	ug/L	--	0.48 UJ	2 U	0.45 UJ	2 UJ	0.48 UJ	2 U	1 U	1 U	0.48 UJ	2.1 U	0.9 U	0.49 U	1 U	1 U	2 U	0.48 UJ	2 UJ
BNA	2,4-Dichlorophenol	ug/L	--	0.48 U	1 U	0.45 UJ	1 UJ	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 UJ	1 UJ
BNA	2,4-Dimethylphenol	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 UJ	0.48 UJ	1 U	1 U	1 U	0.48 UJ	1 U	0.9 U	0.49 UJ	1 U	1 U	1 U	0.48 UJ	1 UJ
BNA	2,4-Dinitrophenol	ug/L	--	0.48 UJ	10 U	0.45 UJ	8.2 UJ	0.48 UJ	10 U	10 U	10 U	0.48 UJ	10 U	9.3 U	0.49 U	10 U	8 UJ	10 U	0.48 UJ	8 UJ
BNA	2,4-Dinitrotoluene	ug/L	--	0.48 U	1 U	0.45 U	1 UJ	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 U	1 UJ
BNA	2,6-Dinitrotoluene	ug/L	--	0.94 U	2 U	0.86 U	2 U	0.96 U	2 U	2 U	2 U	0.96 U	2.1 U	1.9 U	0.49 U	2 U	2 U	2 U	0.85 U	2 U
BNA	2-Chloronaphthalene	ug/L	--	0.48 U	4 U	0.45 UJ	1 U	0.48 U	4 U	4 U	4 U	0.48 U	4 U	3.7 U	0.49 U	4 U	1 U	4 U	0.48 UJ	1 U
BNA	2-Chlorophenol	ug/L	--	0.48 U	1 U	0.45 UJ	1 UJ	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 UJ	1 UJ
BNA	2-Methylnaphthalene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	2-Methylphenol	ug/L	--	0.48 U	1.9 U	0.45 UJ	1.7 U	0.48 U	2 U	1 U	1 U	0.48 U	1.9 U	0.9 U	0.49 U	1.8 U	1 U	1 U	0.48 UJ	1.7 U
BNA	2-Nitroaniline	ug/L	--	0.48 U	1 U	0.45 UJ	1 UJ	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 U	1 UJ
BNA	2-Nitrophenol	ug/L	--	0.48 U	2 U	0.45 UJ	2 U	0.48 U	2 UJ	1 U	1 U	0.48 U	2.1 UJ	0.9 U	0.49 U	1 U	1 U	2 U	0.48 UJ	2 U
BNA	3,3'-Dichlorobenzidine	ug/L	--	0.48 UJ	16 UJ	0.45 U	0.86 UJ	0.48 UJ	1 U	1 U	1 U	0.48 UJ	1 U	0.9 U	0.49 UJ	1 U	1 U	16 UJ	0.48 U	0.85 U
BNA	3-Nitroaniline	ug/L	--	0.48 U	1 U	0.45 UJ	1 UJ	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 U	1 UJ
BNA	4,6-Dinitro-2-methylphenol	ug/L	--	0.94 U	4 U	0.86 U	2 UJ	0.96 U	4 U	4 U	4 U	0.96 U	4 U	3.7 U	0.94 U	4 U	2 U	4.2 U	0.85 U	2 UJ
BNA	4-Bromophenyl-phenylether	ug/L	--	0.48 U	1 U	0.45 U	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 U	1 U
BNA	4-Chloro-3-methylphenol	ug/L	--	0.48 U	2 U	0.45 UJ	2 UJ	0.48 U	2 U	1 U	1 U	0.48 U	2.1 U	0.9 U	0.49 U	1 U	1 U	2 U	0.48 UJ	2 UJ
BNA	4-Chloroaniline	ug/L	--	0.48 UJ	20 UJ	0.45 UJ	0.86 U	0.48 UJ	2 U	2 U	2 U	0.48 UJ	2 U	1.9 U	0.49 UJ	2 U	2 U	20 UJ	0.48 UJ	0.85 U
BNA	4-Chlorophenyl-phenylether	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 UJ	1 U
BNA	4-Methylphenol	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 UJ	1 U
BNA	4-Nitroaniline	ug/L	--	0.48 U	4 UJ	0.45 UJ	4.1 UJ	0.48 U	3.9 UJ	1 U	1 U	0.48 U	4.2 UJ	0.9 U	0.49 U	1 U	1 U	4 UJ	0.48 U	4 UJ
BNA	4-Nitrophenol	ug/L	--	0.48 UJ	20 U	0.45 UJ	20 UJ	0.48 UJ	20 U	4 U	4 U	0.48 UJ	21 UJ	3.7 U	0.49 UJ	4 U	4 U	20 UJ	0.48 UJ	20 UJ
BNA	9H-Carbazole	ug/L	--	0.48 U	4 U	0.45 U	2 UJ	0.48 U	4 U	4 U	4 U	0.48 U	4 U	3.7 U	***4.5***	***59***	2 U	4 U	0.48 U	2 UJ
BNA	Acenaphthene	ug/L	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Acenaphthylene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Acetophenone	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Anthracene	ug/L	9.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Atrazine	ug/L	--	0.48 U	1 U	0.45 U	1 UJ	0.48 U	1 U	1 U	***2.9***	***0.6***	***1***	0.9 U	0.49 U	0.94 U	***0.3 J***	***0.37 J***	0.48 U	1 UJ
BNA	Benzaldehyde	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.48 UJ	1 U	1 U	1 U	0.48 UJ	1 U	0.9 U	0.49 UJ	1 U	1 U	1 U	***0.26 J***	0.85 U
BNA	Benzenemethanol	ug/L	--	1.9 UJ	2 U	1.7 UJ	1.7 UJ	2 U	2 U	2 U	2 U	1.9 UJ	2 U	1.9 U	1.8 UJ	2 U	2 U	2 U	1.7 UJ	1.7 UJ
BNA	Benzo(a)anthracene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(a)pyrene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(b)fluoranthene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(g,h,i)perylene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(k)fluoranthene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzoic acid	ug/L	--	0.94 UJ	8 UJ	0.86 UJ	8.2 UJ	3 U	7.8 UJ	5 UJ	5 UJ	3 U	8.3 UJ	4 UJ	3.5 U	6 UJ	5 UJ	8 UJ	2.4 UJ	8 UJ
BNA	bis(2-Chloroethoxy)methane	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 UJ	1 U
BNA	bis(2-Chloroethyl)ether	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 UJ	1 U
BNA	bis(2-chloroisopropyl)ether	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.48 UJ	1 U	1 U	1 U	0.48 UJ	1 U	0.9 U	0.49 UJ	1 U	1 U	1 U	0.48 UJ	1 U
BNA	bis(2-ethylhexyl)phthalate	ug/L	--	0.48 U	2 U	0.45 U	2 U	0.48 U	2 U	1 U	1 U	0.48 U	2.1 U	1 U	0.49 U	1 UJ	1 U	2 U	0.48 U	2 U
BNA	Butylbenzylphthalate	ug/L	--	0.48 U	1 U	0.45 U	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	1 U	0.49 U	1 U	1 U	1 U	0.48 U	1 U
BNA	Caffeine	ug/L	--	0.48 UJ	1 U	0.45 U	0.45 U	0.48 UJ	1 U	1 U	1 U	0.48 UJ	1 U	0.9 U	0.49 UJ	1 U	1 U	1 U	0.48 U	0.48 U
BNA	Caprolactam	ug/L	--	0.48 UJ	20 U	0.45 UJ	20 U	0.48 UJ	20 U	1 U	1 U	0.48 UJ	21 UJ	0.9 U	0.49 UJ	1 U	1 U	20 U	0.48 UJ	20 U
BNA	Chrysene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Dibenzo(a,h)anthracene	ug/L	0.0070	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Dibenzofuran	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	***2.9***	***29***	1 U	1 U	0.48 UJ	1 U
BNA	Diethylphthalate	ug/L	--	***0.1 J***	2 U	0.45 U	2 UJ	***0.1 J***	2 U	***0.1 J***	***0.1 J***	***0.1 J***	2.1 U	0.9 U	0.49 U	1 U	***0.1 J***	2 U	0.48 U	2 UJ
BNA	Dimethylphthalate	ug/L	--	0.48 UJ	1 U	0.45 U	1 UJ	0.48 UJ	1 U	1 U	1 U	0.48 UJ	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 U	1 UJ
BNA	Di-n-butylphthalate	ug/L	--	0.48 U	2 U	0.45 U	2 UJ	0.48 U	2 U	1 U	1 U	0.48 U	2.1 U	1 U	0.49 U	1 U	1 U	2 U	0.48 U	2 UJ
BNA	Di-n-octylphthalate	ug/L	--	0.48 U	2 U	0.45 U	2 U	0.48 U	2 U	1 U	1 U	0.48 U	2.1 U	0.9 U	0.49 U	1 U	1 U	2 U	0.48 U	2 U
BNA	Ethanone, 1-phenyl-	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	***0.3 J***	0.94 U	1 U	1 U	0.48 UJ	1 U
BNA	Fluoranthene	ug/L	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Fluorene	ug/L	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Hexachlorobenzene	ug/L	--	0.48 U	1 U	0.45 U	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 U	1 U
BNA	Hexachlorobutadiene	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.48 UJ	1 U	1 U	1 U	0.48 UJ	1 U	0.9 U	0.49 UJ	1 U	1 U	1 U	0.48 UJ	1 U
BNA	Hexachlorocyclopentadiene	ug/L	--	0.48 UJ	2 U	0.45 UJ	2 U	0.48 UJ	2 U	2 U	2 U	0.48 UJ	2.1 U	1.9 U	0.49 U	2 U	2 U	2 U	0.48 UJ	2 U
BNA	Hexachloroethane	ug/L	--	0.48 UJ	1 U	0.45 UJ	1 U	0.48 UJ	1 U	1 U	1 U	0.48 UJ	1 U	0.9 U	0.49 UJ	1 U	1 U	1 U	0.48 UJ	1 U
BNA	Indeno(1,2,3-cd)pyrene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

4. S&G OU, Groundwater Sampling Results Summary, 2007-2011

Chemical Group	Analyte	Units	Groundwater Cleanup Level (ug/L)*	99CD-MW04 (4)		SE-02 (3)		PZ3 (4)		PZ-05 (1)	PZ-08 (1)	PZ-09 (4)		PZ-10 (1)	PZ-11 (3)		PZ-12 (2)		P-1L (3)	
				Min	Max	Min	Max	Min	Max			Min	Max		Min	Max	Min	Max	Min	Max
BNA	Isophorone	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 UJ	1 U
BNA	Naphthalene	ug/L	83	1 U	1 U	1 U	1 U	0.98 U	0.98 U	--	--	1 U	1 U	--	--	--	1 U	1 U	1 U	1 U
BNA	Nitrobenzene	ug/L	--	0.48 U	1 U	0.45 UJ	0.86 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 UJ	0.85 U
BNA	n-Nitrosodimethylamine	ug/L	--	1 U	1 U	1 U	1 U	0.98 U	0.98 U	--	--	1 U	1 U	--	--	--	1 U	1 U	1 U	1 U
BNA	n-Nitrosodinpropylamine	ug/L	--	0.48 U	1 U	0.45 UJ	1 UJ	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 UJ	1 UJ
BNA	n-Nitrosodiphenylamine	ug/L	--	0.48 UJ	1 U	0.45 UJ	0.86 UJ	0.48 UJ	1 U	1 U	1 U	0.48 UJ	1 U	0.9 U	0.49 UJ	1 U	1 U	1 U	0.48 UJ	0.85 UJ
BNA	Pentachlorophenol	ug/L	4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Phenanthrene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Phenol	ug/L	--	0.48 U	1 U	0.45 UJ	1 U	0.48 U	1 U	1 U	1 U	0.48 U	1 U	0.9 U	0.49 U	1 U	1 U	1 U	0.48 UJ	1 U
BNA	Pyrene	ug/L	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Retene	ug/L	--	1 U	1 U	--	--	1 U	1 U	1 U	1 U	1 U	1 U	0.9 U	1 U	1 U	1 U	1 U	--	--
General	Dissolved Oxygen	mg/L	--	***0.81***	***5.1***	***2.76***	***9.14***	--	***7.37***	***7.09***	***0.36***	***0.31***	***7.04***	***3.36***	***0***	***2.22***	***2.12***	***3.13***	--	***1.73***
General	Eh	mV	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General	Oxidization Reduction Potential	mV	--	***-50***	***76***	***43***	***135***	***-124***	***78***	***135***	***153***	***163***	***405***	***162***	***-33***	***57***	***130***	***166***	***-46***	***16***
General	pH	units	--	***6.65***	***8.05***	***4.43***	***6.95***	***6.68***	***7.13***	***6.59***	***5.46***	***6.06***	***6.62***	***6.49***	***6.57***	***6.68***	***6.29***	***6.67***	***6.44***	***6.8***
General	Salinity	%	--	--	***0.01***	***0***	***0.01***	--	***0.3***	--	--	--	--	--	--	--	--	***0.01***	***0.8***	***1.2***
General	Specific Conductivity	mS	--	***0.284***	***0.325***	***0.235***	***0.401***	***0.532***	***6.52***	***0.377***	***0.869***	***0.206***	***0.301***	***0.195***	***0.232***	***0.407***	***0.14***	***0.175***	***13.3***	***19.9***
General	Temperature	°C	--	***13.33***	***15.9***	***10.84***	***13.45***	***11.2***	***13.78***	***7.7***	***10.1***	***9.18***	***11.86***	***9.7***	***8.9***	***12.01***	***9.21***	***9.5***	***12.47***	***14.4***
General	Turbidity	ntu	--	***34.6***	***145***	***3.8***	***41.5***	***0.4***	***31***	***3.6***	***19.6***	--	***327***	--	***19.5***	***39.4***	--	***6.6***	***3.7***	***40.3***
PAH	1-Methylnaphthalene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PAH	2-Chloronaphthalene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PAH	2-Methylnaphthalene	ug/L	--	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	0.21	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Acenaphthene	ug/L	3.0	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	***1.4***	***35***	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Acenaphthylene	ug/L	--	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***0.026 J***	0.029 U	0.03 U	0.029 U	***0.055***	***1.4***	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Anthracene	ug/L	9	0.029 U	***0.037***	0.029 U	0.029 U	***0.056***	***0.099***	0.03 U	***0.37***	***0.053***	***0.09***	***0.054***	***0.13***	***0.8***	***0.044***	***0.064***	0.029 U	0.031 U
PAH	Benzo(a)anthracene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Benzo(a)pyrene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Benzo(b)fluoranthene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Benzo(g,h,i)perylene	ug/L	--	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Benzo(k)fluoranthene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Chrysene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Dibenzo(a,h)anthracene	ug/L	0.0070	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Fluoranthene	ug/L	3.0	0.029 U	***0.051***	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	***0.18***	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Fluorene	ug/L	3.0	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	***0.13***	***9***	0.029 U	0.031 U	0.029 U	0.031 U
PAH	HPAH	ug/L	0.25	0.029 U	***0.089***	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	***0.222***	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Indeno(1,2,3-cd)pyrene	ug/L	0.0296	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Naphthalene	ug/L	83	0.029 U	***0.18***	0.029 U	***0.048***	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	***0.026 J***	***14***	***130***	0.029 U	0.031 U	0.029 U	***0.15***
PAH	Phenanthrene	ug/L	--	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	***2.8***	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Pyrene	ug/L	15	0.029 U	***0.038***	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U	0.029 U	0.03 U	0.029 U	0.029 U	***0.042***	0.029 U	0.031 U	0.029 U	0.031 U
PCP	Pentachlorophenol	ug/L	4.9	0.074 U	0.078 U	0.074 U	0.075 U	0.075 U	0.078 U	0.077 U	0.074 U	0.074 U	0.077 U	0.074 U	0.074 U	0.08 U	0.074 U	0.078 U	0.074 U	0.078 U
TPH	Diesel (#2)	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Lube Oil	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	TPH-GC/Diesel Range Organics	ug/L	--	93 U	190 U	93 U	190 U	93 U	190 U	96 U	93 U	94 U	200 U	93 U	94 U	***560***	96 U	190 U	93 U	190 U
TPH	TPH-GC/Motor Oil Range Organic	ug/L	--	190 U	460 U	190 U	460 U	190 U	480 U	190 U	190 U	190 U	490 U	190 U	190 U	190 U	190 U	480 U	190 U	460 U

NOTES:

CW01 (4) = Monitoring Well Name. Number of sampling events in parentheses.

BNA = base/neutral and acid extractables

General = general chemistry

HPAH = High molecular weight Polynuclear Aromatic Hydrocarbon compounds

PAH = polynuclear aromatic hydrocarbons

TPH = total petroleum hydrocarbons

* From Wyckoff ROD 2/2000

U Upper Aquifer Well

Bold and italics = Detected value

Reporting limit for non-detect value exceeds Groundwater Cleanup Le

Detected value exceeds Groundwater Cleanup Level

4. S&G OU, Groundwater Sampling Results Summary, 2007-2011

Chemical Group	Analyte	Units	Groundwater Cleanup Level (ug/L)*	P-2L (3)		P-3L (3)		P-4L (3)		P-5L (3)		P-6L (3)		VG-1L (3)		VG-2L (3)		VG-3L (3)	
				Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
BNA	1,1'-Biphenyl	ug/L	--	0.48 U	1 U	0.4 J	6.4 J	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 U	0.68 J	2 J	0.49 U	1 UJ
BNA	1,2,4,5-Tetrachlorobenzene	ug/L	--	0.48 UJ	0.48 UJ	0.5 U	0.5 U	0.51 U	0.51 U	0.49 U	0.49 U	0.5 U	0.5 U	0.45 UJ	0.45 UJ	0.47 UJ	0.47 UJ	0.49 U	0.49 U
BNA	1,2,4-Trichlorobenzene	ug/L	--	0.48 UJ	1 U	0.5 UJ	1.1 UJ	0.51 UJ	1.1 UJ	0.49 UJ	0.98 U	0.5 UJ	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 UJ	1 UJ
BNA	1,2-Dichlorobenzene	ug/L	--	0.85 U	1 U	0.93 U	1.1 UJ	0.93 U	1.1 UJ	0.96 U	0.98 U	0.96 U	1 U	0.86 U	0.98 U	0.85 U	0.98 U	0.96 U	1 UJ
BNA	1,2-Diphenylhydrazine	ug/L	--	0.85 U	1 UJ	0.93 UJ	1.1 U	0.93 UJ	1.1 U	0.96 UJ	0.98 U	0.96 UJ	1 U	0.86 U	0.98 UJ	0.85 UJ	0.98 UJ	0.96 UJ	1 UJ
BNA	1,3-Dichlorobenzene	ug/L	--	0.85 U	1 U	0.93 U	1.1 U	0.93 U	1.1 U	0.96 U	0.98 U	0.96 U	1 U	0.86 U	0.98 U	0.85 U	0.98 U	0.96 U	1 UJ
BNA	1,4-Dichlorobenzene	ug/L	--	0.85 U	1 U	0.93 U	1.1 UJ	0.93 U	1.1 UJ	0.96 U	0.98 U	0.96 U	1 U	0.86 U	0.98 U	0.85 U	0.98 U	0.96 U	1 UJ
BNA	1-Methylnaphthalene	ug/L	--	0.48 UJ	0.85 U	41	41	0.51 U	0.93 U	0.49 U	0.96 U	0.5 U	0.96 U	0.45 UJ	0.86 U	1.6	6.7 UJ	0.49 U	0.96 U
BNA	2,3,4,6-Tetrachlorophenol	ug/L	--	0.48 U	0.48 U	0.5 U	0.5 U	0.51 U	0.51 U	0.49 U	0.49 U	0.5 U	0.5 U	0.45 U	0.45 U	0.47 U	0.47 U	0.49 U	0.49 U
BNA	2,4,5-Trichlorophenol	ug/L	--	0.48 UJ	2 UJ	0.5 UJ	2.2 U	0.51 UJ	2.2 U	0.49 UJ	2 UJ	0.5 UJ	2 UJ	0.45 UJ	2 UJ	0.47 UJ	2 UJ	0.49 UJ	2 UJ
BNA	2,4,6-Trichlorophenol	ug/L	--	0.48 UJ	2 UJ	0.5 UJ	2.2 U	0.51 UJ	2.2 U	0.49 UJ	2 U	0.5 UJ	2 U	0.45 UJ	2 UJ	0.47 UJ	2 UJ	0.49 UJ	2 UJ
BNA	2,4-Dichlorophenol	ug/L	--	0.48 UJ	1 UJ	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 UJ	0.47 UJ	0.98 UJ	0.49 U	1 UJ
BNA	2,4-Dimethylphenol	ug/L	--	0.48 UJ	1 UJ	0.5 UJ	1.1 U	0.51 UJ	1.1 U	0.49 UJ	0.98 U	0.5 UJ	1 U	0.45 UJ	0.98 UJ	0.47 UJ	0.98 UJ	0.49 UJ	1 UJ
BNA	2,4-Dinitrophenol	ug/L	--	0.48 UJ	8 UJ	0.5 U	8.9 U	0.51 UJ	8.7 U	0.49 UJ	7.8 U	0.5 UJ	8.2 U	0.45 UJ	7.8 UJ	0.47 UJ	7.8 UJ	0.49 UJ	8.2 UJ
BNA	2,4-Dinitrotoluene	ug/L	--	0.48 U	1 UJ	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 U	0.98 UJ	0.47 U	0.98 UJ	0.49 U	1 UJ
BNA	2,6-Dinitrotoluene	ug/L	--	0.85 U	2 U	0.93 U	2.2 U	0.93 U	2.2 U	0.96 U	2 U	0.96 U	2 U	0.86 U	2 U	0.85 U	2 U	0.96 U	2 UJ
BNA	2-Chloronaphthalene	ug/L	--	0.48 UJ	1 U	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 U	1 UJ
BNA	2-Chlorophenol	ug/L	--	0.48 UJ	1 UJ	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 UJ	0.47 UJ	0.98 UJ	0.49 U	1 UJ
BNA	2-Methylnaphthalene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	2-Methylphenol	ug/L	--	0.48 UJ	1.7 U	0.5 U	1.9 U	0.51 U	1.9 U	0.49 U	1.9 U	0.5 U	1.9 U	0.45 UJ	1.7 U	0.47 UJ	1.7 U	0.49 U	1.9 U
BNA	2-Nitroaniline	ug/L	--	0.48 U	1 UJ	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 U	0.98 UJ	0.47 UJ	0.98 UJ	0.49 UJ	1 UJ
BNA	2-Nitrophenol	ug/L	--	0.48 UJ	2 U	0.5 U	2.2 U	0.51 U	2.2 U	0.49 U	2 U	0.5 U	2 U	0.45 UJ	2 U	0.47 UJ	2 U	0.49 U	2 UJ
BNA	3,3'-Dichlorobenzidine	ug/L	--	0.48 U	0.85 U	0.5 UJ	18 UJ	0.51 UJ	17 UJ	0.49 UJ	16 UJ	0.5 UJ	16 UJ	0.86 U	0.86 U	0.47 U	0.85 UJ	0.49 UJ	18 UJ
BNA	3-Nitroaniline	ug/L	--	0.48 U	1 UJ	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 UJ	0.5 U	1 UJ	0.45 U	0.98 UJ	0.47 UJ	0.98 UJ	0.49 UJ	1 UJ
BNA	4,6-Dinitro-2-methylphenol	ug/L	--	0.85 U	2 UJ	0.93 U	2.2 U	0.93 U	2.2 U	0.96 U	2 U	0.96 U	2 U	0.86 U	2 UJ	0.85 U	2 UJ	0.96 U	2 UJ
BNA	4-Bromophenyl-phenylether	ug/L	--	0.48 U	1 U	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 U	0.98 U	0.47 U	0.98 U	0.49 U	1 UJ
BNA	4-Chloro-3-methylphenol	ug/L	--	0.48 UJ	2 UJ	0.5 U	2.2 U	0.51 U	2.2 U	0.49 U	2 U	0.5 U	2 U	0.45 UJ	2 UJ	0.47 UJ	2 UJ	0.49 U	2 UJ
BNA	4-Chloroaniline	ug/L	--	0.48 UJ	0.85 U	0.5 UJ	22 UJ	0.51 UJ	22 UJ	0.49 UJ	20 UJ	0.5 UJ	20 UJ	0.45 UJ	0.86 U	0.47 UJ	0.85 U	0.49 UJ	20 UJ
BNA	4-Chlorophenyl-phenylether	ug/L	--	0.48 UJ	1 U	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 U	1 UJ
BNA	4-Methylphenol	ug/L	--	0.48 UJ	1 U	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 U	1 UJ
BNA	4-Nitroaniline	ug/L	--	0.48 U	4 UJ	0.5 U	4.4 U	0.51 U	4.3 U	0.49 U	3.9 UJ	0.5 U	4.1 UJ	0.45 U	3.9 UJ	0.47 UJ	3.9 UJ	0.49 UJ	4.1 UJ
BNA	4-Nitrophenol	ug/L	--	0.48 UJ	20 UJ	0.5 UJ	22 U	0.51 UJ	22 U	0.49 UJ	20 U	0.5 UJ	20 U	0.45 UJ	20 UJ	0.47 UJ	20 UJ	0.49 UJ	20 UJ
BNA	9H-Carbazole	ug/L	--	0.48 U	2 UJ	1.5 J	38	0.19 J	0.51 U	0.49 U	2 U	0.5 U	2 U	0.86 U	2 UJ	0.96 J	12	0.49 U	2 UJ
BNA	Acenaphthene	ug/L	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Acenaphthylene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Acetophenone	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Anthracene	ug/L	9.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Atrazine	ug/L	--	0.48 U	1 UJ	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 U	0.98 UJ	0.47 U	0.98 UJ	0.49 U	1 UJ
BNA	Benzaldehyde	ug/L	--	0.48 UJ	1 U	0.5 UJ	1.1 U	0.51 UJ	1.1 U	0.49 UJ	0.98 U	0.5 UJ	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 UJ	1 UJ
BNA	Benzenemethanol	ug/L	--	1.7 UJ	1.7 UJ	1.9 UJ	1.9 UJ	1.9 UJ	1.9 UJ	1.9 UJ	1.9 UJ	1.9 UJ	1.9 UJ	1.7 UJ	1.7 UJ	1.7 UJ	1.7 UJ	1.9 UJ	1.9 UJ
BNA	Benzo(a)anthracene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(a)pyrene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(b)fluoranthene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(g,h,i)perylene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzo(k)fluoranthene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Benzoic acid	ug/L	--	2.4 UJ	8 UJ	4.5 U	8.9 UJ	3.5 U	8.7 UJ	2.8 U	7.8 UJ	2.6	8.2 UJ	0.86 UJ	7.8 UJ	4.9 UJ	7.8 UJ	2.8 U	8.2 UJ
BNA	bis(2-Chloroethoxy)methane	ug/L	--	0.48 UJ	1 U	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 U	1 UJ
BNA	bis(2-Chloroethyl)ether	ug/L	--	0.48 UJ	1 U	0.5 U	1.1 U	0.51 UJ	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 U	1 UJ
BNA	bis(2-chloroisopropyl)ether	ug/L	--	0.48 UJ	1 U	0.5 UJ	1.1 U	0.51 U	1.1 U	0.49 UJ	0.98 U	0.5 UJ	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 UJ	1 UJ
BNA	bis(2-ethylhexyl)phthalate	ug/L	--	0.48 U	2 U	0.5 U	2.2 U	0.51 U	2.2 U	0.49 U	2 U	0.5 U	2 U	0.86 U	2 U	0.47 U	2 U	0.49 U	2 UJ
BNA	Butylbenzylphthalate	ug/L	--	0.48 U	1 U	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.86 U	0.98 U	0.47 U	0.98 U	0.49 U	1 UJ
BNA	Caffeine	ug/L	--	0.48 U	0.48 U	0.5 UJ	0.5 UJ	0.51 UJ	0.51 UJ	0.49 UJ	0.49 UJ	0.5 UJ	0.5 UJ	--	--	0.47 U	0.47 U	0.49 UJ	0.49 UJ
BNA	Caprolactam	ug/L	--	0.48 UJ	20 U	0.5 UJ	22 U	0.51 UJ	22 U	0.49 UJ	20 U	0.5 UJ	20 U	0.45 UJ	20 U	0.47 UJ	20 U	0.49 UJ	20 UJ
BNA	Chrysene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Dibenzo(a,h)anthracene	ug/L	0.0070	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Dibenzofuran	ug/L	--	0.48 UJ	1 U	1.1 J	16	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.047 J	0.86 U	6.1	8.6 J	0.49 U	1 UJ
BNA	Diethylphthalate	ug/L	--	0.48 U	2 UJ	0.5 U	2.2 U	0.51 U	2.2 U	0.49 U	2 U	0.5 U	2 U	0.45 U	2 UJ	0.47 U	2 UJ	0.49 U	2 UJ
BNA	Dimethylphthalate	ug/L	--	0.48 U	1 UJ	0.5 UJ	1.1 U	0.51 UJ	1.1 U	0.49 UJ	0.98 U	0.5 UJ	1 U	0.45 U	0.98 UJ	0.47 U	0.98 UJ	0.49 UJ	1 UJ
BNA	Di-n-butylphthalate	ug/L	--	0.48 U	2 UJ	0.5 U	2.2 U	0.51 U	2.2 U	0.49 U	2 U	0.5 U	2 U	0.86 U	2 UJ	0.47 U	2 UJ	0.49 U	2 UJ
BNA	Di-n-octylphthalate	ug/L	--	0.48 U	2 U	0.5 U	2.2 U	0.51 U	2.2 U	0.49 U	2 U	0.5 U	2 U	0.86 U	2 U	0.47 U	2 U	0.49 U	2 UJ
BNA	Ethanone, 1-phenyl-	ug/L	--	0.48 UJ	1 U	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 U	1 UJ
BNA	Fluoranthene	ug/L	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Fluorene	ug/L	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Hexachlorobenzene	ug/L	--	0.48 U	1 U	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 U	0.98 U	0.47 U	0.98 U	0.49 U	1 UJ
BNA	Hexachlorobutadiene	ug/L	--	0.48 UJ	1 U	0.5 UJ	1.1 U	0.51 UJ	1.1 U	0.49 UJ	0.98 U	0.5 UJ	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 UJ	1 UJ
BNA	Hexachlorocyclopentadiene	ug/L	--	0.48 UJ	2 U	0.5 UJ	2.2 U	0.51 UJ	2.2 U	0.49 UJ	2 U	0.5 UJ	2 U	0.45 UJ	2 U	0.47 UJ	2 U	0.49 UJ	2 UJ
BNA	Hexachloroethane	ug/L	--	0.48 UJ	1 U	0.5 UJ	1.1 U	0.51 UJ	1.1 U	0.49 UJ	0.98 U	0.5 UJ	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 UJ	1 UJ
BNA	Indeno(1,2,3-cd)pyrene	ug/L	0.030	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

4. S&G OU, Groundwater Sampling Results Summary, 2007-2011

Chemical Group	Analyte	Units	Groundwater Cleanup Level (ug/L)*	P-2L (3)		P-3L (3)		P-4L (3)		P-5L (3)		P-6L (3)		VG-1L (3)		VG-2L (3)		VG-3L (3)	
				Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
BNA	Isophorone	ug/L	--	0.48 UJ	1 U	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 U	1 UJ
BNA	Naphthalene	ug/L	83	1 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U	0.98 U	0.98 U	1 U	1 U	0.98 U	0.98 U	0.98 U	0.98 U	1 UJ	1 UJ
BNA	Nitrobenzene	ug/L	--	0.48 UJ	0.85 U	0.5 U	0.93 U	0.51 U	0.93 U	0.49 U	0.96 U	0.5 U	0.96 U	0.45 UJ	0.86 U	0.47 UJ	0.85 U	0.49 U	0.96 U
BNA	n-Nitrosodimethylamine	ug/L	--	1 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U	0.98 U	0.98 U	1 U	1 U	0.98 U	0.98 U	0.98 U	0.98 U	1 UJ	1 UJ
BNA	n-Nitrosodinpropylamine	ug/L	--	0.48 UJ	1 UJ	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 UJ	0.47 UJ	0.98 UJ	0.49 U	1 UJ
BNA	n-Nitrosodiphenylamine	ug/L	--	0.48 UJ	0.85 UJ	0.5 UJ	0.93 UJ	0.51 UJ	0.93 UJ	0.49 UJ	0.96 UJ	0.5 UJ	0.96 UJ	0.45 UJ	0.86 UJ	0.47 UJ	0.85 UJ	0.49 UJ	0.96 UJ
BNA	Pentachlorophenol	ug/L	4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Phenanthrene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Phenol	ug/L	--	0.48 UJ	1 U	0.5 U	1.1 U	0.51 U	1.1 U	0.49 U	0.98 U	0.5 U	1 U	0.45 UJ	0.98 U	0.47 UJ	0.98 U	0.49 U	1 UJ
BNA	Pyrene	ug/L	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BNA	Retene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General	Dissolved Oxygen	mg/L	--	--	***4.2***	--	***1.85***	--	***1.93***	***6.9***	***9.75***	***3.77***	***8.01***	--	***4.43***	***0***	***1.96***	***3.98***	***8.39***
General	Eh	mV	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General	Oxidization Reduction Potential	mV	--	***-130***	***-92***	***-202***	***27***	***-131***	***-67***	***87***	***102***	***80***	***255***	***-11***	***109***	***-187***	***-70***	***91***	***255***
General	pH	units	--	***6.9***	***9.17***	***6.59***	***6.87***	***7.02***	***7.43***	***7.28***	***7.63***	***8.05***	***8.98***	***6.84***	***7.23***	***6.71***	***8.37***	***6.76***	***7.76***
General	Salinity	%	--	***1.09***	***1.5***	***1.6***	***2.3***	***1.4***	***1.9***	--	***0.01***	--	***0.01***	***0.2***	***0.4***	***1.6***	***2.1***	--	***0.03***
General	Specific Conductivity	mS	--	***18.7***	***24.4***	***26.3***	***37.5***	***23.2***	***31.3***	***0.247***	***0.309***	***0.247***	***0.282***	***4.58***	***7.55***	***26.2***	***34.2***	***0.412***	***0.705***
General	Temperature	°C	--	***11.07***	***13.47***	***11.38***	***13.59***	***12.14***	***15.11***	***11.42***	***15***	***11.5***	***15.16***	***12.52***	***14.58***	***11.87***	***13.41***	***11.8***	***14.09***
General	Turbidity	ntu	--	--	***13***	--	***43.4***	--	***28.4***	***0.7***	***68.4***	***1.3***	***41.8***	--	***52.1***	***0.1***	***321***	--	***19.8***
PAH	1-Methylnaphthalene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PAH	2-Chloronaphthalene	ug/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PAH	2-Methylnaphthalene	ug/L	--	0.029 U	0.031 U	***1.8***	***7.7***	0.03 U	***0.098***	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	***9.1***	0.029 U	0.031 U
PAH	Acenaphthene	ug/L	3.0	0.029 U	***0.051***	***4.4***	***25***	***0.032***	***0.083***	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	***0.088***	***5***	***26***	0.029 U	0.031 U
PAH	Acenaphthylene	ug/L	--	0.029 U	0.031 U	***0.045***	***0.35***	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	***0.067***	***0.6***	0.029 U	0.031 U
PAH	Anthracene	ug/L	9	0.029 U	0.031 U	***0.21***	***0.82***	0.03 U	***0.074***	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	***1.1***	***1.8***	0.029 U	0.031 U
PAH	Benzo(a)anthracene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	***0.16***	***0.44*** J	0.029 U	0.031 U
PAH	Benzo(a)pyrene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Benzo(b)fluoranthene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	***0.06*** J	0.029 U	0.031 U
PAH	Benzo(g,h,i)perylene	ug/L	--	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 UJ
PAH	Benzo(k)fluoranthene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Chrysene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	***0.095***	***0.18***	0.029 U	0.031 U
PAH	Dibenzo(a,h)anthracene	ug/L	0.0070	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Fluoranthene	ug/L	3.0	0.029 U	0.031 U	***0.4***	***0.7***	***0.25***	***0.41***	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	***0.088***	***2.8***	***6.5***	0.029 U	0.031 U
PAH	Fluorene	ug/L	3.0	0.029 U	0.031 U	***0.96***	***9.3***	***0.062***	***0.11***	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	***3.6***	***12***	0.029 U	0.031 U
PAH	HPAH	ug/L	0.25	0.029 U	0.031 U	***0.66***	***1.08***	***0.39***	***0.64***	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	***0.125***	***4.655***	***10.23***	0.029 U	0.031 U
PAH	Indeno(1,2,3-cd)pyrene	ug/L	0.0296	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.03 U	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.029 U	0.031 U
PAH	Naphthalene	ug/L	83	0.029 U	***0.063***	***25***	***590*** J	***0.55***	***1.2***	0.029 U	***0.089***	0.029 U	***0.045***	0.029 U	***0.084***	***0.68***	***170***	0.029 U	***0.049***
PAH	Phenanthrene	ug/L	--	0.029 U	0.031 U	***0.71***	***7.5***	***0.085***	***0.58***	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	0.029 U	***11***	***20***	0.029 U	0.031 U
PAH	Pyrene	ug/L	15	0.029 U	0.031 U	***0.26***	***0.38***	***0.14***	***0.23***	0.029 U	0.031 U	0.029 U	0.031 U	0.029 U	***0.037***	***1.5***	***3.1***	0.029 U	0.031 U
PCP	Pentachlorophenol	ug/L	4.9	0.074 U	0.078 U	0.074 U	0.075 U	0.074 U	0.077 U	0.074 U	0.078 U	0.074 U	0.078 U	0.074 U	0.075 U	0.074 U	0.08 U	0.074 U	0.08 U
TPH	Diesel (#2)	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Lube Oil	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	TPH-GC/Diesel Range Organics	ug/L	--	93 U	200 U	***89***	***1600***	93 U	190 U	93 U	200 U	94 U	200 U	93 U	190 U	98 U	***490***	93 U	***640***
TPH	TPH-GC/Motor Oil Range Organic	ug/L	--	190 U	490 U	190 U	460 U	190 U	460 U	190 U	500 U	190 U	490 U	190 U	470 U	190 U	480 U	190 U	480 U

NOTES:

CW01 (4) = Monitoring Well Name Number of sampling events in parentheses.

BNA = base/neutral and acid extractables

General = general chemistry

HPAH = High molecular weight Polynuclear Aromatic Hydrocarbon compounds

PAH = polynuclear aromatic hydrocarbons

TPH = total petroleum hydrocarbons

* From Wyckoff ROD 2/2000

U Upper Aquifer Well

Bold and italics = Detected value

Reporting limit for non-detect value exceeds Groundwater Cleanup Le

Detected value exceeds Groundwater Cleanup Level

4. S&G OU, Groundwater Sampling Results Summary, 2007-2011

Chemical Group	Analyte	Units	Groundwater Cleanup Level (ug/L)[a]	VG-4L (3)		VG-5L (3)		MW21 [U] (3)		PZ-06 [U] (1)	PZ-07 [U] (1)
				Min	Max	Min	Max	Min	Max		
BNA	1,1'-Biphenyl	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	5.6
BNA	1,2,4,5-Tetrachlorobenzene	ug/L	--	0.48 U	0.48 U	0.51 U	0.51 U	0.46 U	0.46 U	--	--
BNA	1,2,4-Trichlorobenzene	ug/L	--	0.48 UJ	1 U	0.51 UJ	1 U	0.46 UJ	1 U	1 U	1 U
BNA	1,2-Dichlorobenzene	ug/L	--	0.94 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BNA	1,2-Diphenylhydrazine	ug/L	--	0.94 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BNA	1,3-Dichlorobenzene	ug/L	--	0.94 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BNA	1,4-Dichlorobenzene	ug/L	--	0.94 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BNA	1-Methylnaphthalene	ug/L	--	0.48 U	0.94 U	0.51 U	1 U	0.46 U	1 U	1 U	31
BNA	2,3,4,6-Tetrachlorophenol	ug/L	--	0.48 U	0.48 U	0.51 U	0.51 U	0.46 U	0.46 U	--	--
BNA	2,4,5-Trichlorophenol	ug/L	--	0.48 UJ	2 UJ	0.51 UJ	2 UJ	0.46 UJ	2 U	1 U	1 U
BNA	2,4,6-Trichlorophenol	ug/L	--	0.48 UJ	2 U	0.51 UJ	2 U	0.46 UJ	2 U	1 U	1 U
BNA	2,4-Dichlorophenol	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	2,4-Dimethylphenol	ug/L	--	0.48 UJ	1 U	0.51 U	1 U	0.46 UJ	1 U	1 U	12
BNA	2,4-Dinitrophenol	ug/L	--	0.48 UJ	8 U	0.51 UJ	8.2 U	0.46 UJ	8 UJ	10 U	10 U
BNA	2,4-Dinitrotoluene	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	2,6-Dinitrotoluene	ug/L	--	0.94 U	2 U	1 U	2 U	0.93 U	2 U	2 U	2 U
BNA	2-Chloronaphthalene	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	4 U	4 U
BNA	2-Chlorophenol	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	2-Methylnaphthalene	ug/L	--	--	--	--	--	--	--	--	--
BNA	2-Methylphenol	ug/L	--	0.48 U	1.8 U	0.51 U	2 U	0.46 U	2 U	1 U	0.8 J
BNA	2-Nitroaniline	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	2-Nitrophenol	ug/L	--	0.48 U	2 U	0.51 U	2 U	0.46 U	2 UJ	1 U	1 U
BNA	3,3'-Dichlorobenzidine	ug/L	--	0.48 UJ	16 UJ	0.51 UJ	16 UJ	0.48 UJ	1 UJ	1 U	1 U
BNA	3-Nitroaniline	ug/L	--	0.48 U	1 UJ	0.51 U	1 UJ	0.46 U	1 UJ	1 U	1 U
BNA	4,6-Dinitro-2-methylphenol	ug/L	--	0.94 U	2 U	1 U	2 U	0.93 U	2 U	4 U	4 U
BNA	4-Bromophenyl-phenylether	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	4-Chloro-3-methylphenol	ug/L	--	0.48 U	2 U	0.51 U	2 U	0.46 U	2 U	1 U	1 U
BNA	4-Chloroaniline	ug/L	--	0.48 UJ	20 UJ	0.51 UJ	20 UJ	0.46 UJ	1 U	2 U	2 U
BNA	4-Chlorophenyl-phenylether	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	4-Methylphenol	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	2.2
BNA	4-Nitroaniline	ug/L	--	0.48 U	4 UJ	0.51 U	4.1 UJ	0.46 U	4 UJ	1 U	1 U
BNA	4-Nitrophenol	ug/L	--	0.48 UJ	20 U	0.51 UJ	20 U	0.46 UJ	20 UJ	4 U	4 U
BNA	9H-Carbazole	ug/L	--	0.48 U	2 U	0.51 U	2 U	0.46 U	2 U	4 U	11
BNA	Acenaphthene	ug/L	3.0	--	--	--	--	--	--	--	--
BNA	Acenaphthylene	ug/L	--	--	--	--	--	--	--	--	--
BNA	Acetophenone	ug/L	--	--	--	--	--	--	--	--	--
BNA	Anthracene	ug/L	9.0	--	--	--	--	--	--	--	--
BNA	Atrazine	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	0.5 J	1 U	1 U
BNA	Benzaldehyde	ug/L	--	0.48 UJ	1 U	0.51 U	1 U	0.46 UJ	1 U	1 U	1 U
BNA	Benzenemethanol	ug/L	--	1.8 UJ	1.8 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 U	2 U
BNA	Benzo(a)anthracene	ug/L	0.030	--	--	--	--	--	--	--	--
BNA	Benzo(a)pyrene	ug/L	0.030	--	--	--	--	--	--	--	--
BNA	Benzo(b)fluoranthene	ug/L	0.030	--	--	--	--	--	--	--	--
BNA	Benzo(g,h,i)perylene	ug/L	--	--	--	--	--	--	--	--	--
BNA	Benzo(k)fluoranthene	ug/L	0.030	--	--	--	--	--	--	--	--
BNA	Benzoic acid	ug/L	--	3 U	8 UJ	3.1 U	8.2 UJ	3.1 U	8 UJ	5 UJ	5 UJ
BNA	bis(2-Chloroethoxy)methane	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	bis(2-Chloroethyl)ether	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	bis(2-chloroisopropyl)ether	ug/L	--	0.48 UJ	1 U	0.51 U	1 U	0.46 UJ	1 U	1 U	1 U
BNA	bis(2-ethylhexyl)phthalate	ug/L	--	0.48 U	2 U	0.51 U	2 U	0.46 U	2 U	1 U	1 U
BNA	Butylbenzylphthalate	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	Caffeine	ug/L	--	0.48 UJ	0.48 UJ	0.51 UJ	0.51 UJ	0.46 UJ	0.46 UJ	1 U	1 U
BNA	Caprolactam	ug/L	--	0.48 UJ	20 U	0.51 UJ	20 U	0.46 UJ	20 U	1 U	1 U
BNA	Chrysene	ug/L	0.030	--	--	--	--	--	--	--	--
BNA	Dibenzo(a,h)anthracene	ug/L	0.0070	--	--	--	--	--	--	--	--
BNA	Dibenzofuran	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	17
BNA	Diethylphthalate	ug/L	--	0.48 U	2 U	0.51 U	2 U	0.46 U	2 U	0.1 J	1 U
BNA	Dimethylphthalate	ug/L	--	0.48 UJ	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	Di-n-butylphthalate	ug/L	--	0.48 U	2 U	0.51 U	2 U	0.46 U	2 U	1 U	1 U
BNA	Di-n-octylphthalate	ug/L	--	0.48 U	2 U	0.51 U	2 U	0.46 U	2 U	1 U	1 U
BNA	Ethanone, 1-phenyl-	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	Fluoranthene	ug/L	3.0	--	--	--	--	--	--	--	--
BNA	Fluorene	ug/L	3.0	--	--	--	--	--	--	--	--
BNA	Hexachlorobenzene	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	Hexachlorobutadiene	ug/L	--	0.48 UJ	1 U	0.51 UJ	1 U	0.46 UJ	1 U	1 U	1 U
BNA	Hexachlorocyclopentadiene	ug/L	--	0.48 UJ	2 U	0.51 UJ	2 U	0.46 UJ	2 U	2 U	2 U
BNA	Hexachloroethane	ug/L	--	0.48 UJ	1 U	0.51 UJ	1 U	0.46 UJ	1 U	1 U	1 U
BNA	Indeno(1,2,3-cd)pyrene	ug/L	0.030	--	--	--	--	--	--	--	--

4. S&G OU, Groundwater Sampling Results Summary, 2007-2011

Chemical Group	Analyte	Units	Groundwater Cleanup Level (ug/L)*	VG-4L (3)		VG-5L (3)		MW21 U (3)		PZ-06 U (1)	PZ-07 U (1)
				Min	Max	Min	Max	Min	Max		
BNA	Isophorone	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	Naphthalene	ug/L	83	1 U	1 U	1 U	1 U	1 U	1 U	--	--
BNA	Nitrobenzene	ug/L	--	0.48 U	0.94 U	0.51 U	1 U	0.46 U	0.46 U	1 U	1 U
BNA	n-Nitrosodimethylamine	ug/L	--	1 U	1 U	1 U	1 U	1 U	1 U	--	--
BNA	n-Nitrosodinpropylamine	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	n-Nitrosodiphenylamine	ug/L	--	0.48 UJ	0.94 UJ	0.51 UJ	1 UJ	0.46 UJ	1 UJ	1 U	1 U
BNA	Pentachlorophenol	ug/L	4.9	--	--	--	--	--	--	--	--
BNA	Phenanthrene	ug/L	--	--	--	--	--	--	--	--	--
BNA	Phenol	ug/L	--	0.48 U	1 U	0.51 U	1 U	0.46 U	1 U	1 U	1 U
BNA	Pyrene	ug/L	15	--	--	--	--	--	--	--	--
BNA	Retene	ug/L	--	--	--	--	--	--	--	1 U	1 U
General	Dissolved Oxygen	mg/L	--	***4.84***	***7.38***	***1.43***	***3.87***	--	***1.7***	***7.89***	***0.28***
General	Eh	mV	--	--	--	--	--	--	--	--	--
General	Oxidization Reduction Potential	mV	--	***111***	***212***	***55***	***171***	***-134***	***287***	***126***	***-57***
General	pH	units	--	***7.66***	***7.97***	***7.25***	***8.44***	***6.13***	***6.74***	***7.02***	***6.86***
General	Salinity	%	--	--	***0.01***	--	***0.01***	--	--	--	--
General	Specific Conductivity	mS	--	***0.272***	***0.286***	***0.265***	***0.346***	***0.371***	***0.651***	***0.232***	***0.999***
General	Temperature	°C	--	***11.59***	***14.7***	***12.1***	***15.3***	***11.42***	***16.96***	***5.5***	***6.8***
General	Turbidity	ntu	--	***2.8***	***7.3***	***6.3***	***59.9***	***5.5***	***223***	***6.8***	***30.8***
PAH	1-Methylnaphthalene	ug/L	--	--	--	--	--	--	--	--	--
PAH	2-Chloronaphthalene	ug/L	--	--	--	--	--	--	--	--	--
PAH	2-Methylnaphthalene	ug/L	--	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***2.5***
PAH	Acenaphthene	ug/L	3.0	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	***0.18***	0.03 U	***45***
PAH	Acenaphthylene	ug/L	--	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	***0.056***	0.03 U	***0.36***
PAH	Anthracene	ug/L	9	0.029 U	0.031 U	0.029 U	0.029 U	***0.1***	***0.76***	***0.12***	***1.7***
PAH	Benzo(a)anthracene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***0.04***
PAH	Benzo(a)pyrene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***0.03***
PAH	Benzo(b)fluoranthene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***0.047***
PAH	Benzo(g,h,i)perylene	ug/L	--	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 UJ	0.03 U	***0.04***
PAH	Benzo(k)fluoranthene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U
PAH	Chrysene	ug/L	0.030	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***0.037***
PAH	Dibenzo(a,h)anthracene	ug/L	0.0070	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	0.029 U
PAH	Fluoranthene	ug/L	3.0	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***1***
PAH	Fluorene	ug/L	3.0	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***14***
PAH	HPAH	ug/L	0.25	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***1.732***
PAH	Indeno(1,2,3-cd)pyrene	ug/L	0.0296	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***0.038***
PAH	Naphthalene	ug/L	83	0.029 U	***0.093***	0.029 U	***0.045***	0.029 U	***0.065***	0.03 U	***55***
PAH	Phenanthrene	ug/L	--	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***8.7***
PAH	Pyrene	ug/L	15	0.029 U	0.031 U	0.029 U	0.029 U	0.029 U	0.031 U	0.03 U	***0.5***
PCP	Pentachlorophenol	ug/L	4.9	0.074 U	0.08 U	0.074 U	0.075 U	0.074 U	0.078 U	0.077 U	0.075 U
TPH	Diesel (#2)	mg/L	--	--	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	--	--	--	--	--	--	--	--
TPH	Lube Oil	mg/L	--	--	--	--	--	--	--	--	--
TPH	TPH-GC/Diesel Range Organics	ug/L	--	94 U	190 U	94 U	200 U	94 U	190 U	96 U	***490***
TPH	TPH-GC/Motor Oil Range Organic	ug/L	--	190 U	460 U	190 U	500 U	190 U	460 U	190 U	190 U

NOTES:

CW01 (4) = Monitoring Well Name. Number of sampling events in parentheses.

BNA = base/neutral and acid extractables

General = general chemistry

HPAH = High molecular weight Polynuclear Aromatic Hydrocarbon compounds

PAH = polynuclear aromatic hydrocarbons

TPH = total petroleum hydrocarbons

* From Wyckoff ROD 2/2000

U Upper Aquifer Well

Bold and italics = Detected value

Reporting limit for non-detect value exceeds Groundwater Cleanup Le

Detected value exceeds Groundwater Cleanup Level

5. S&G OU, Contaminant Concentration over Time

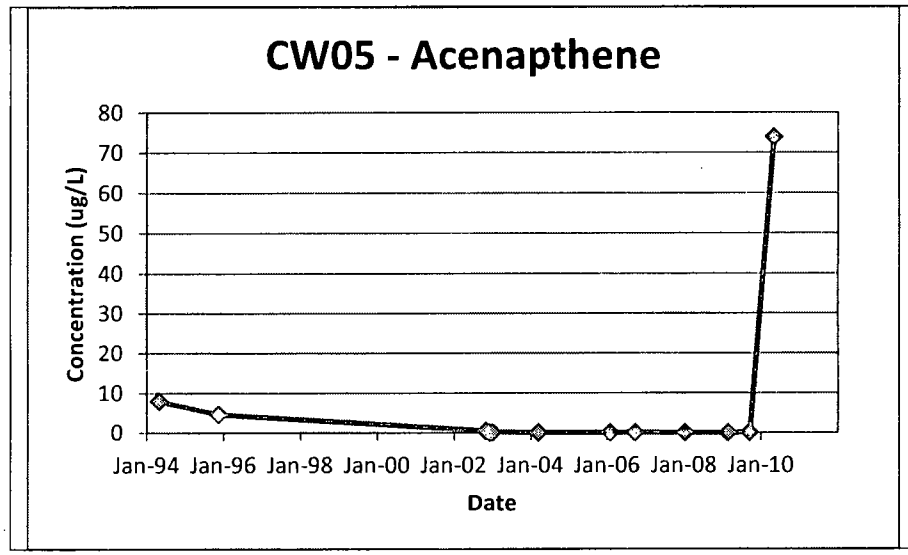
Concentration versus time graphs were constructed for constituents detected above Groundwater Cleanup Levels between 2007 and 2011. Elevated concentrations in 2010 associated with a period of non-containment during the startup and initial operation of the new groundwater treatment plant.

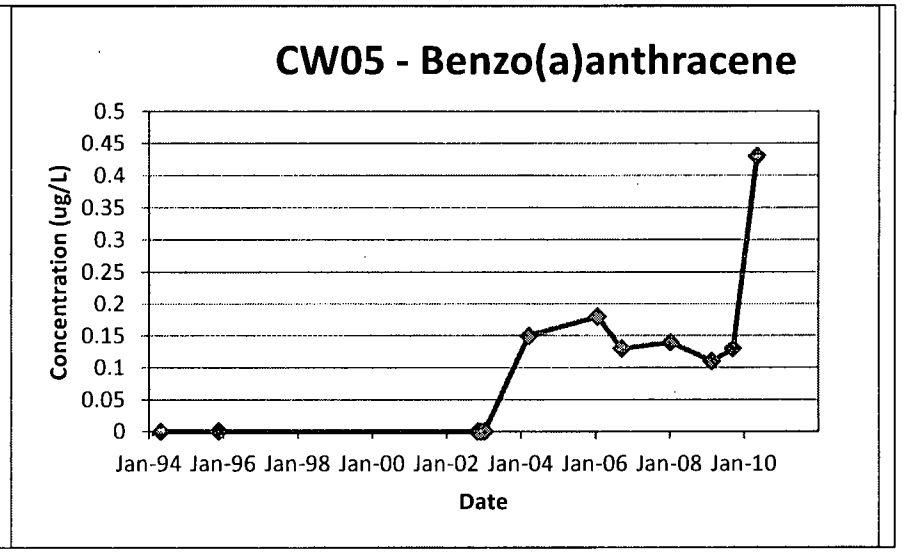
GRAPH NOTES:

Non-detect values depicted as 0.

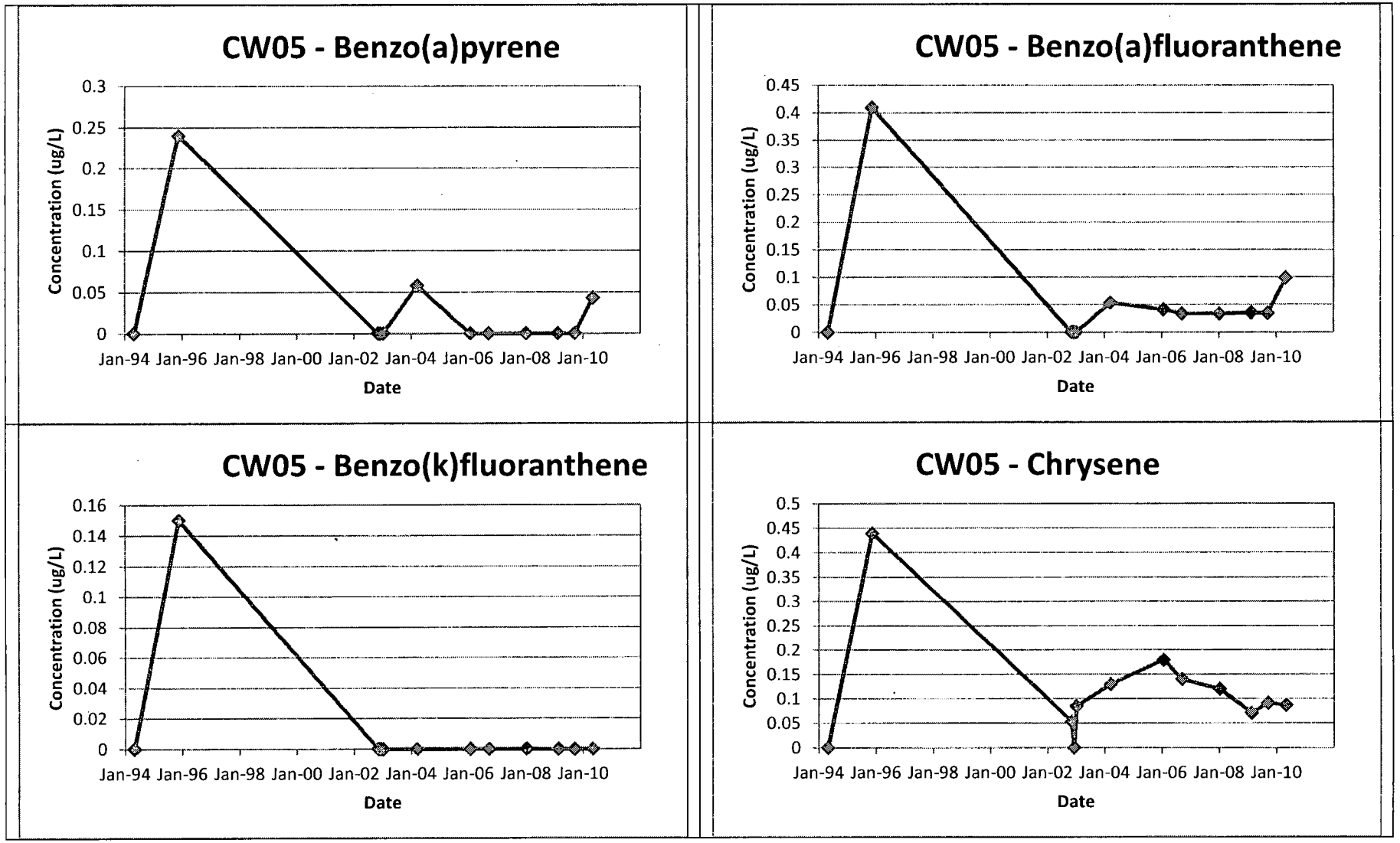
HPAH = High molecular weight Polynuclear Aromatic Hydrocarbon compounds

ug/L = microgram/liter

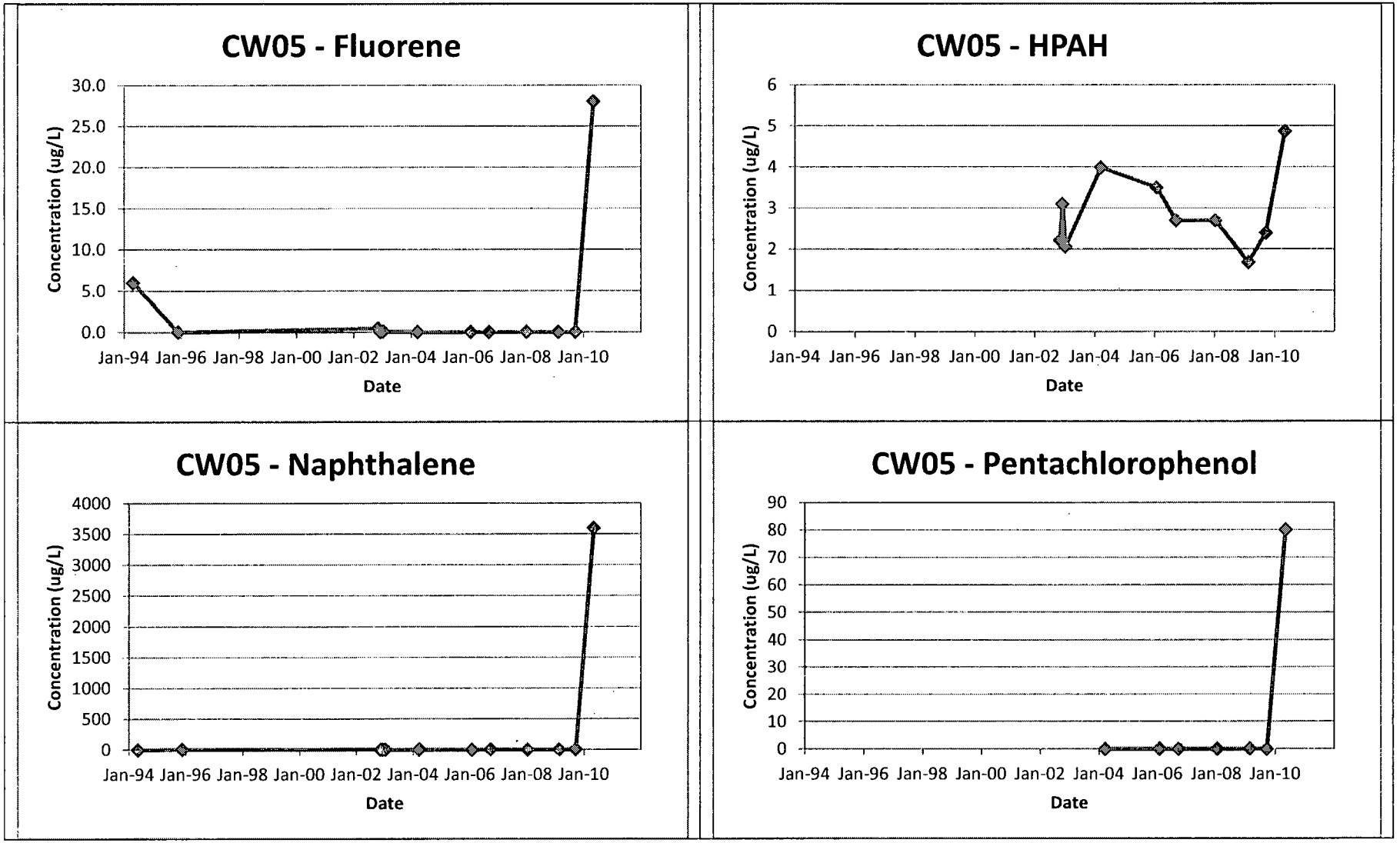




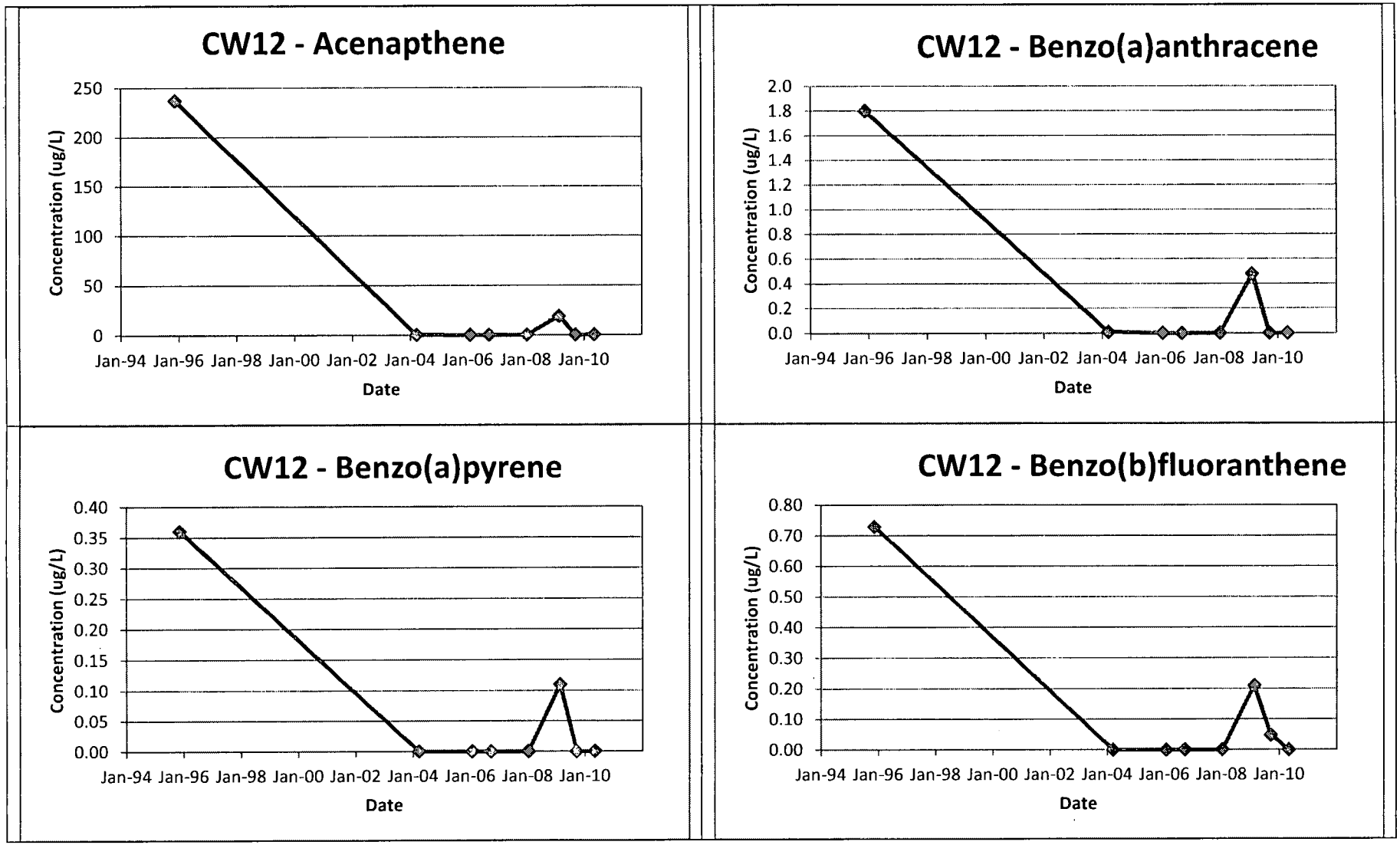
5. S&G OU, Contaminant Concentration over Time



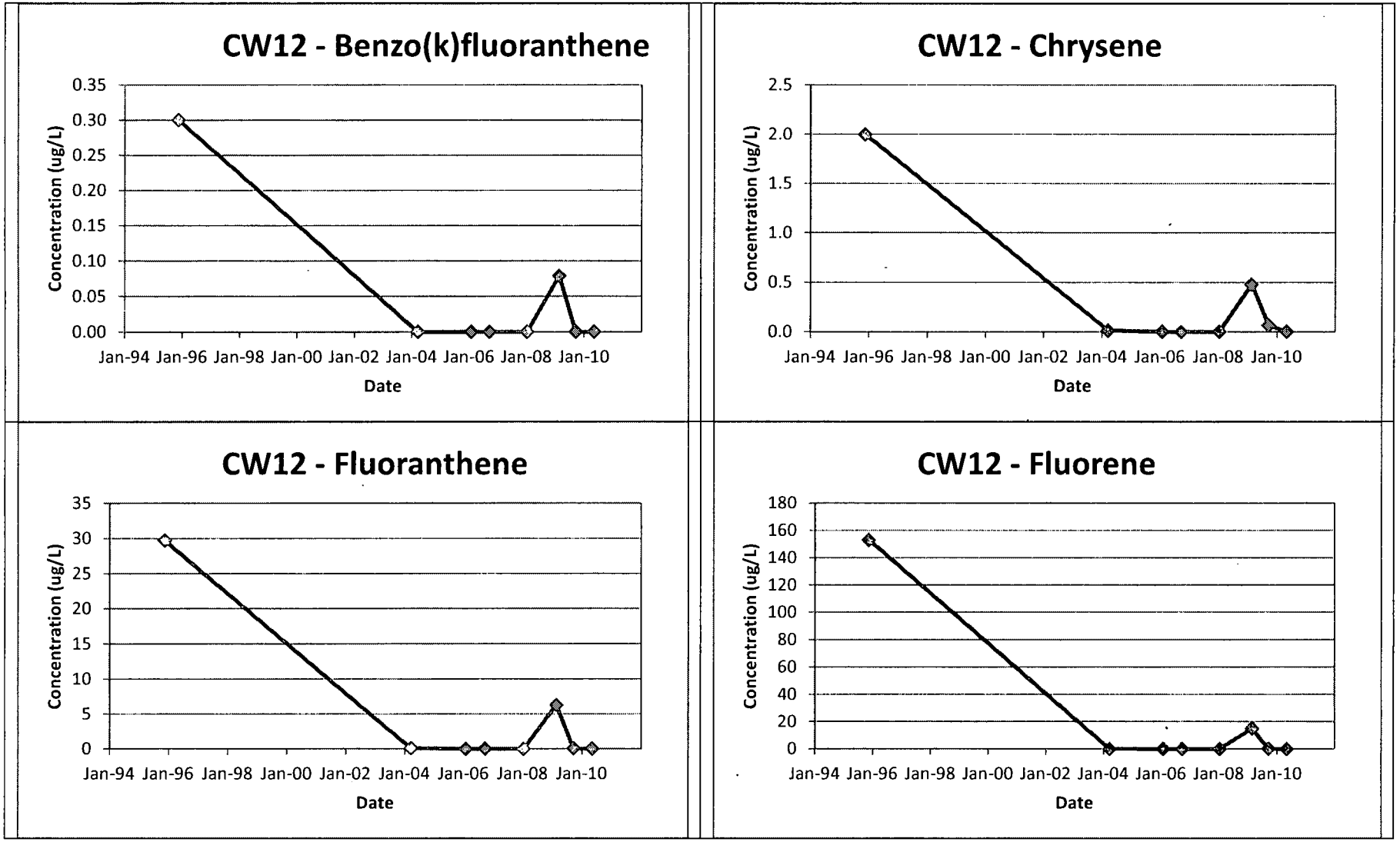
5. S&G OU, Contaminant Concentration over Time



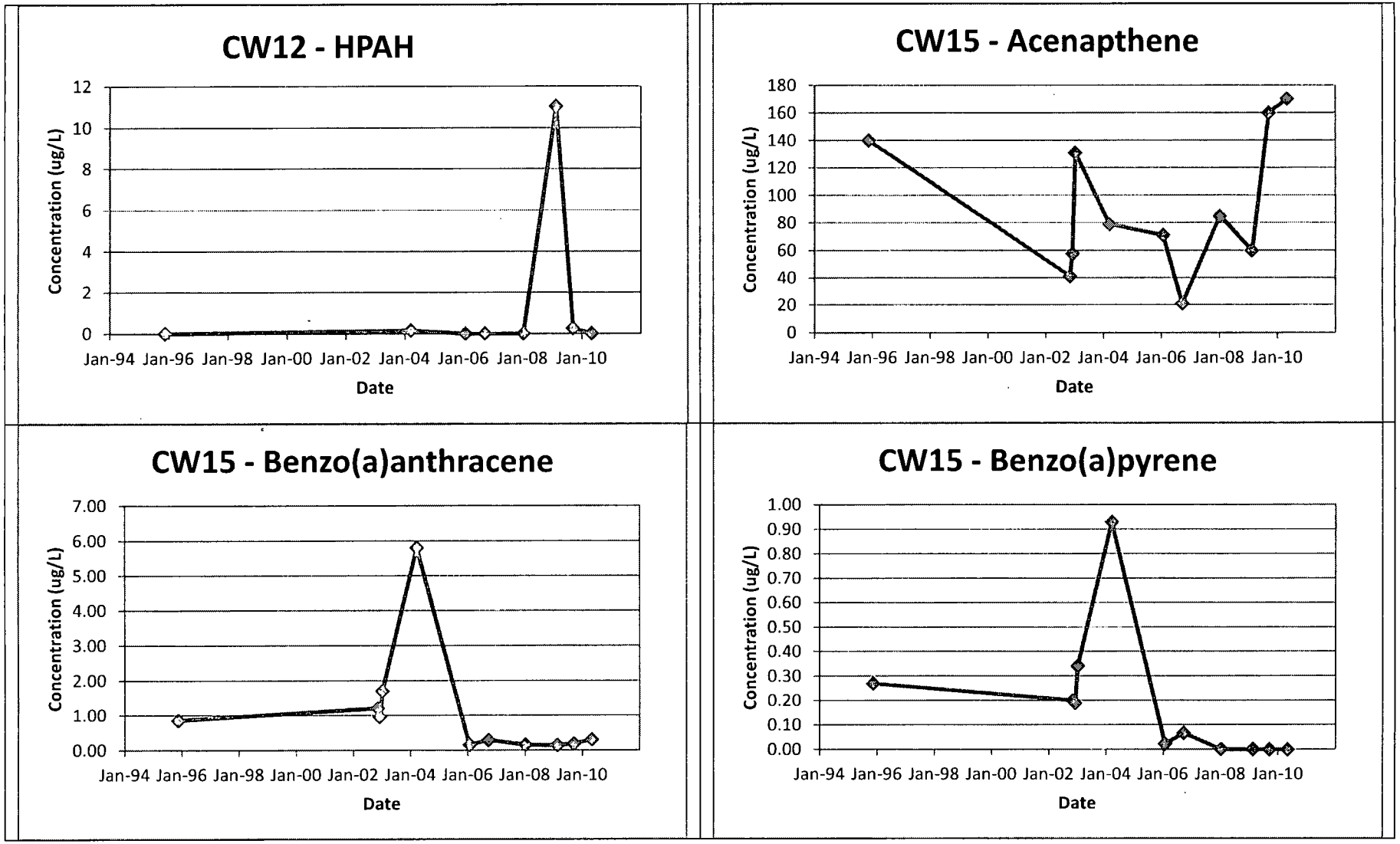
5. S&G OU, Contaminant Concentration over Time



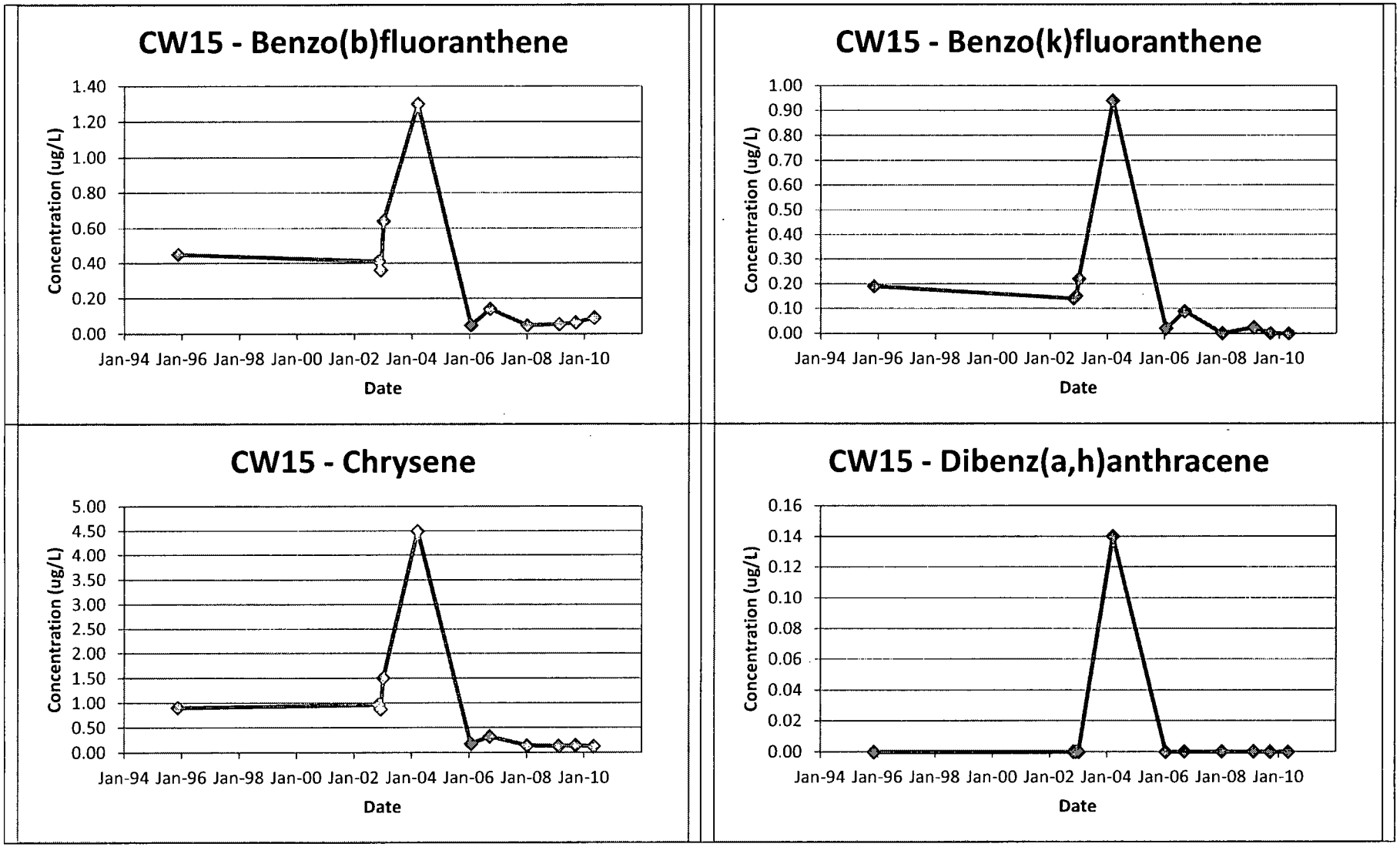
5. S&G OU, Contaminant Concentration over Time



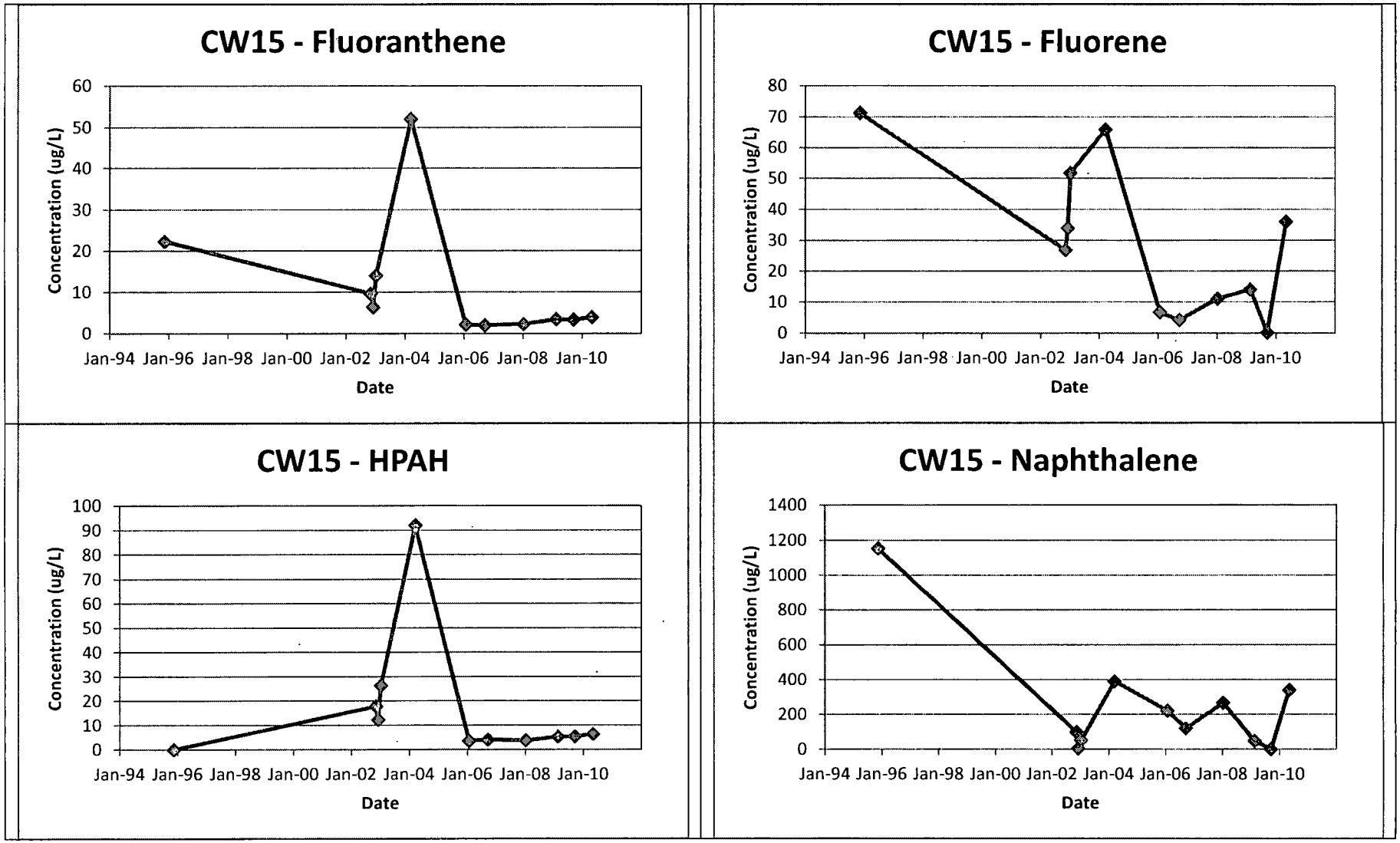
5. S&G OU, Contaminant Concentration over Time



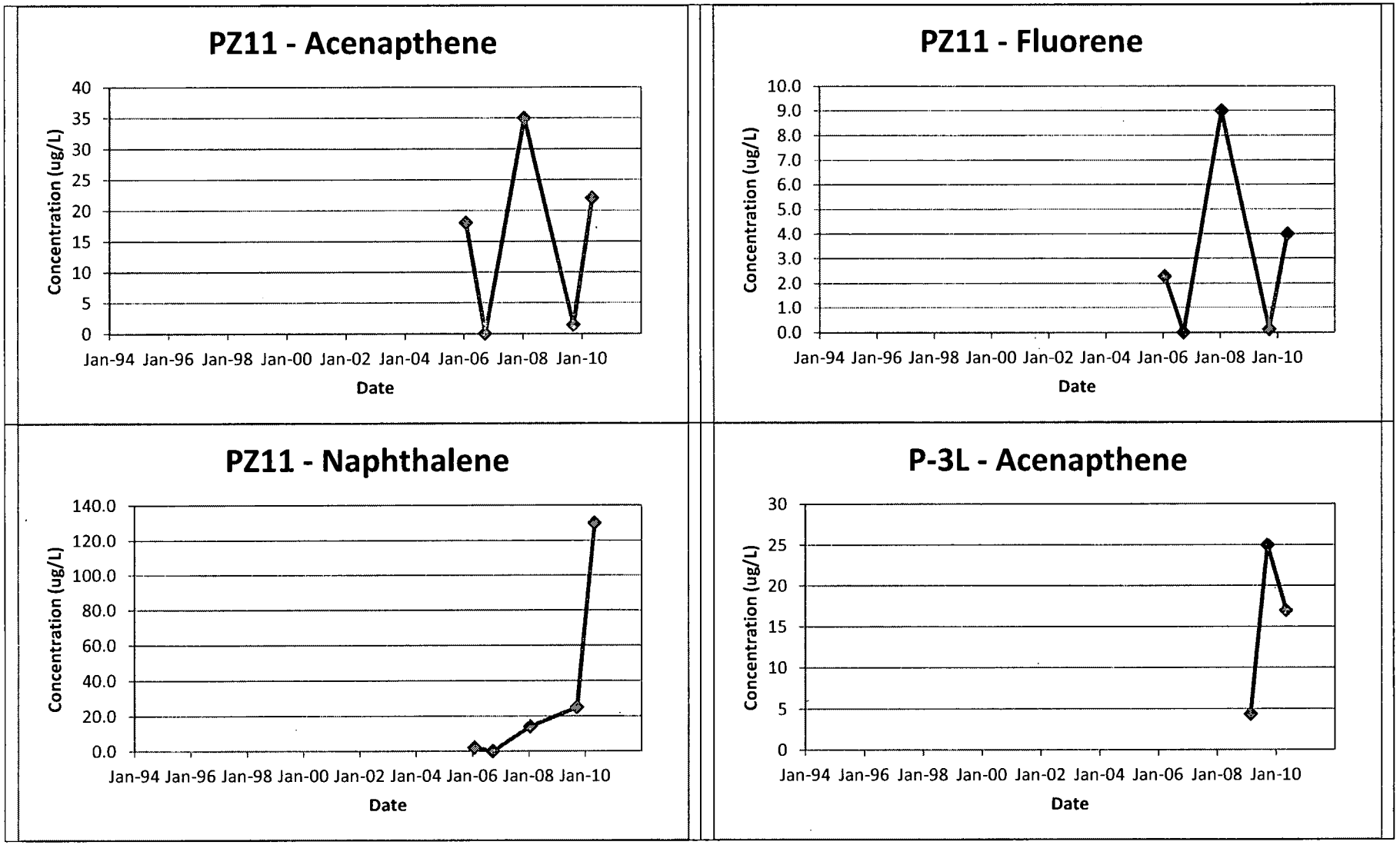
5. S&G OU, Contaminant Concentration over Time



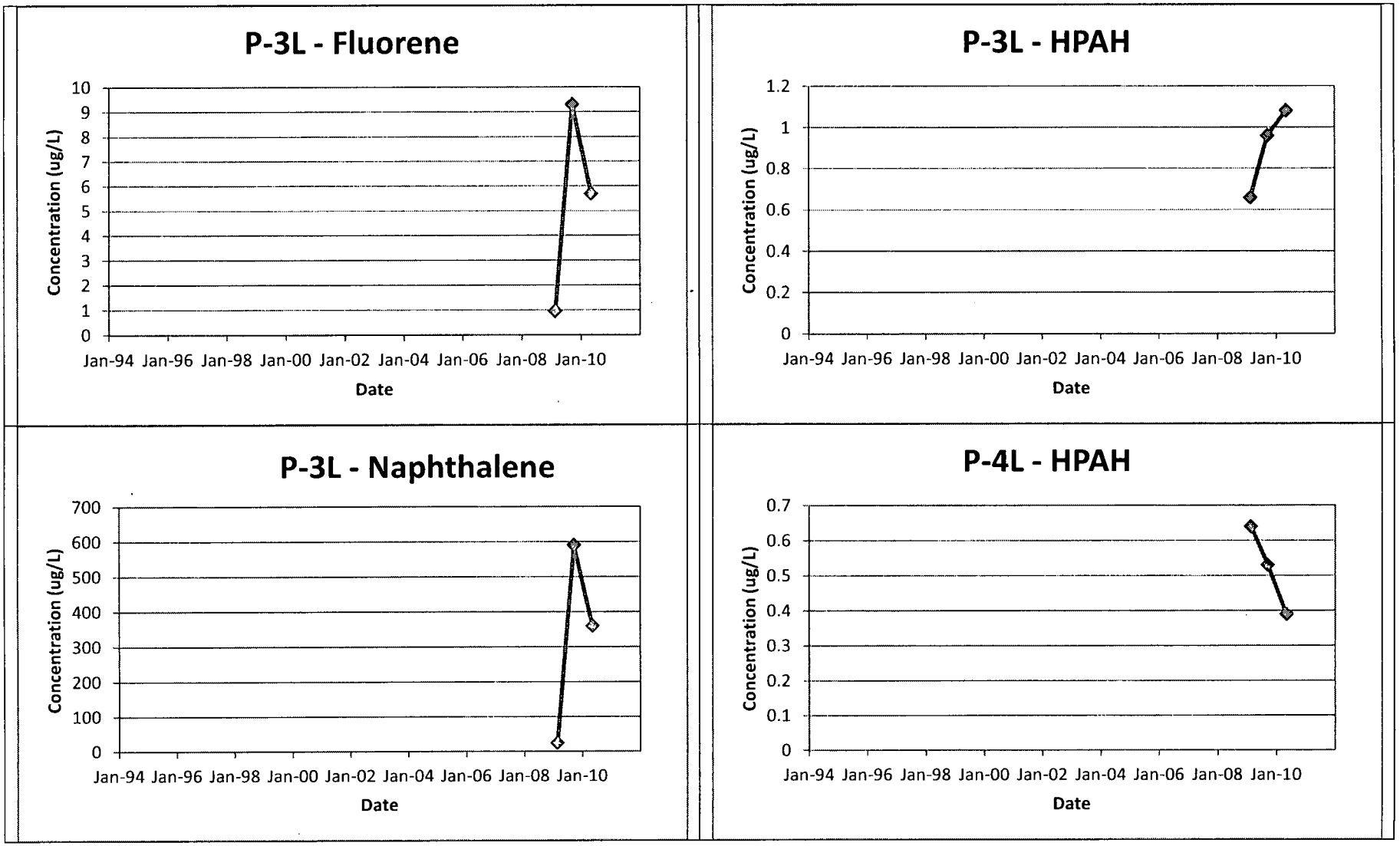
5. S&G OU, Contaminant Concentration over Time



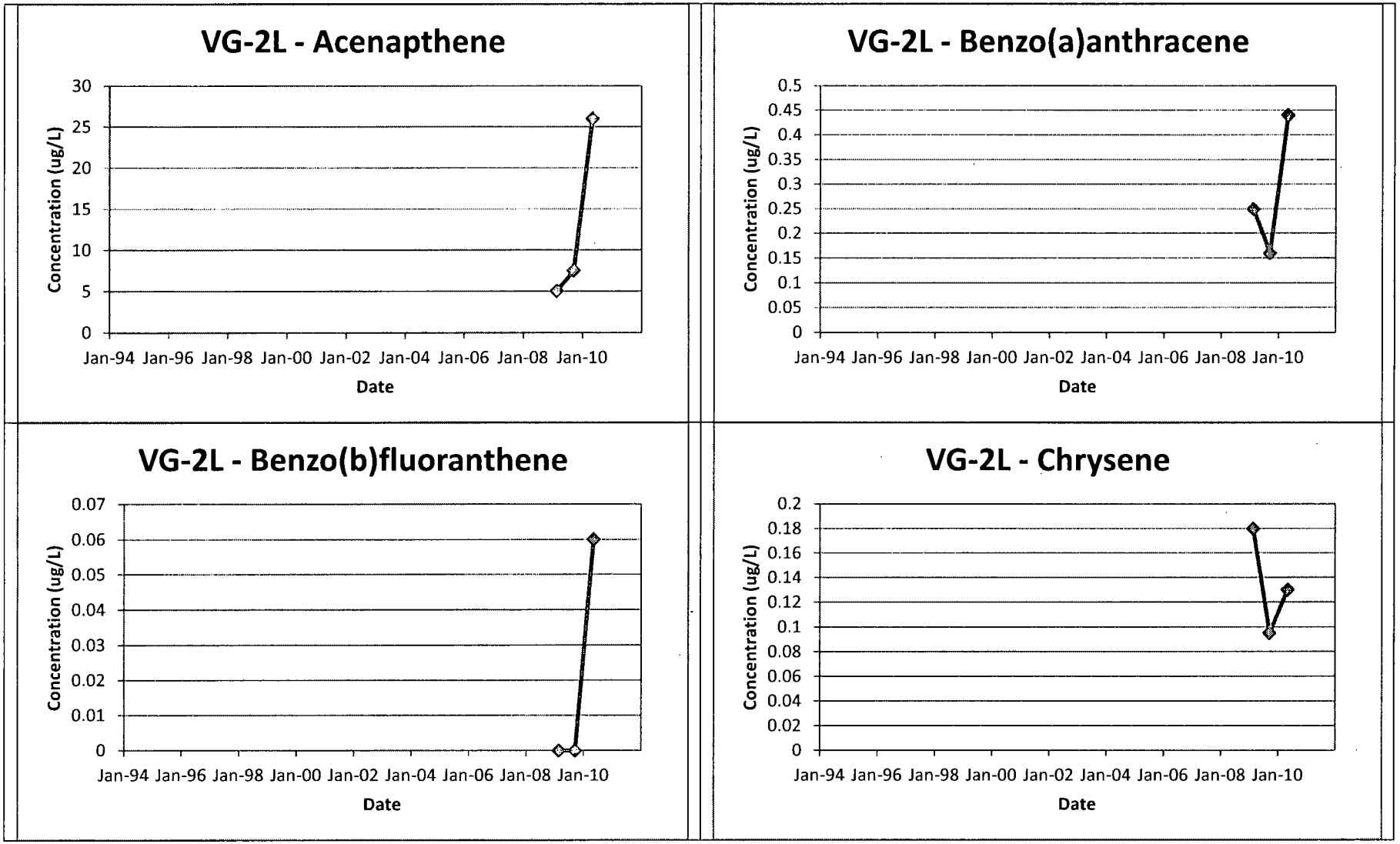
5. S&G OU, Contaminant Concentration over Time



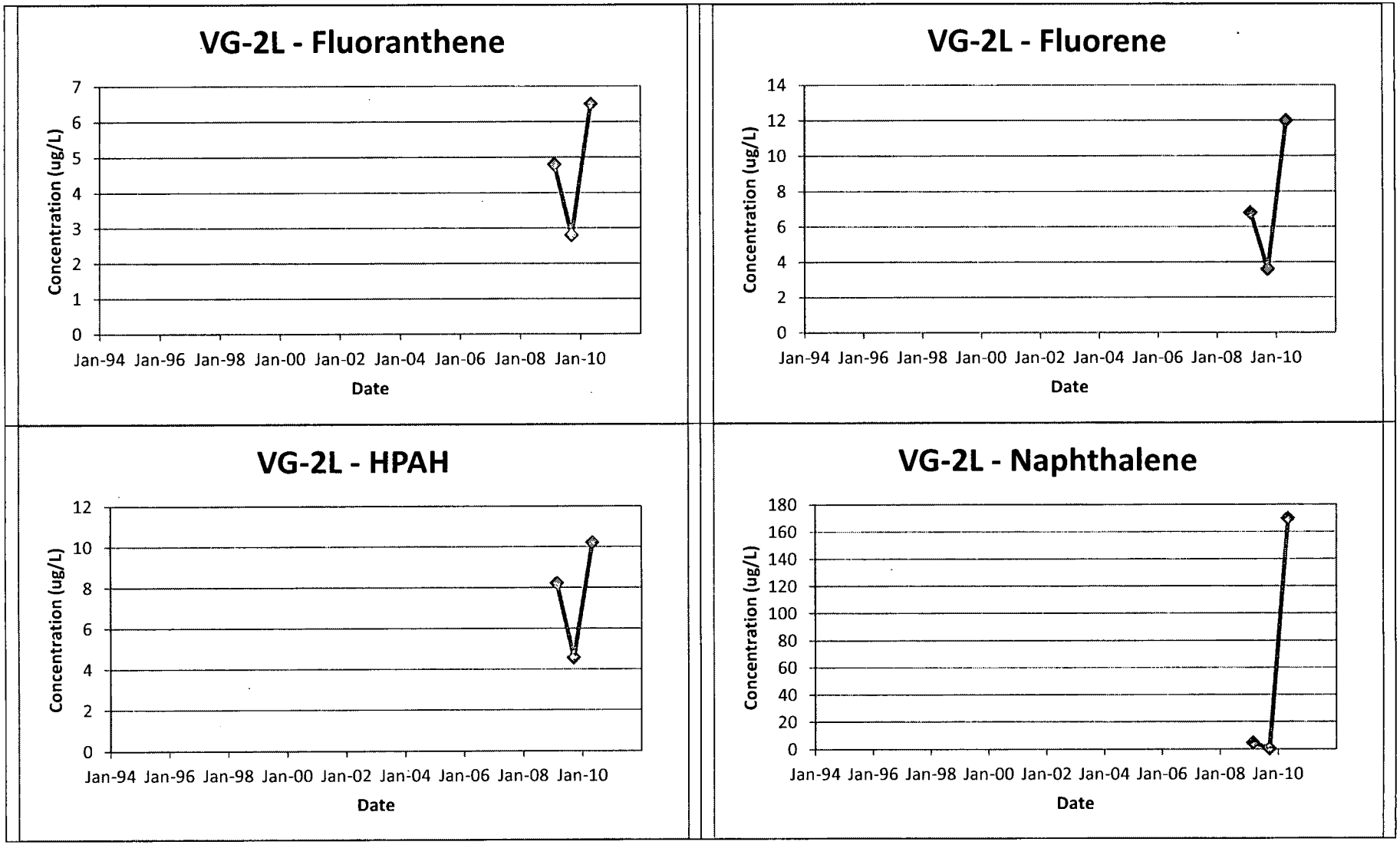
5. S&G OU, Contaminant Concentration over Time



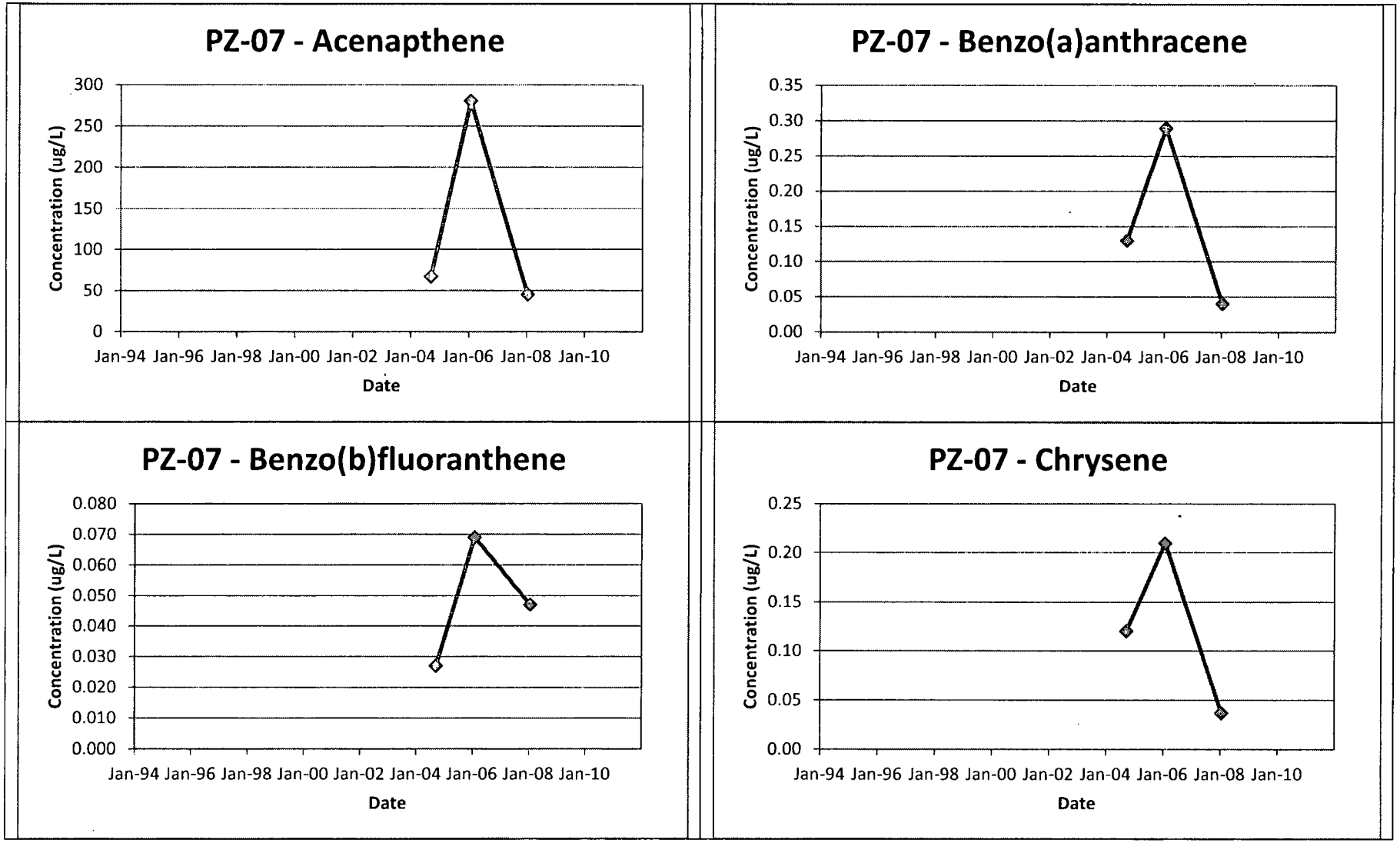
5. S&G OU, Contaminant Concentration over Time



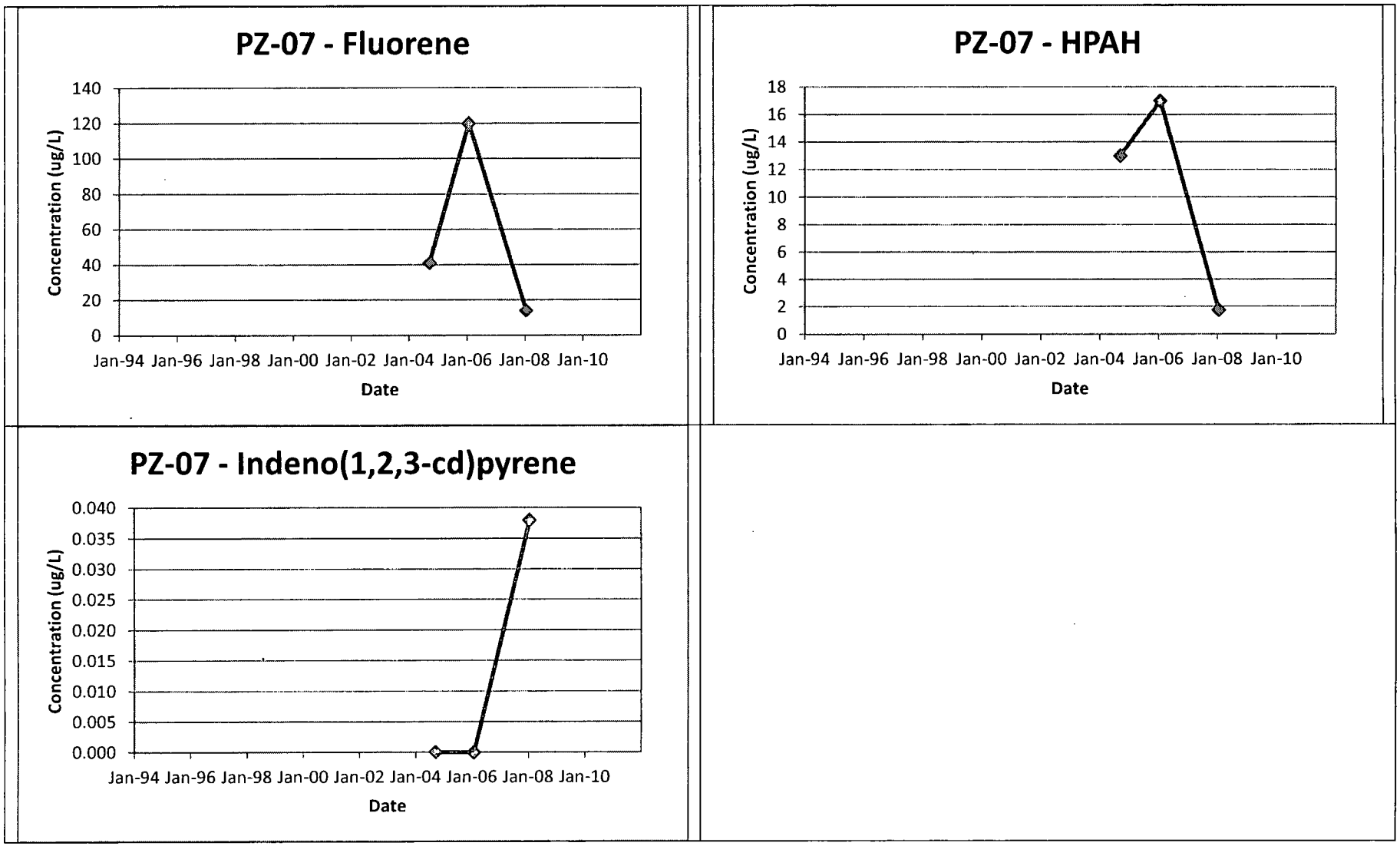
5. S&G OU, Contaminant Concentration over Time



5. S&G OU, Contaminant Concentration over Time



5. S&G OU, Contaminant Concentration over Time



6. WHOU, Summary of Site and Stormwater Inspections at Eagle Harbor Year 10-14 (2007-2011). (modified From Herrera 2012)

Inspection Event and Date	Potential Problem Observed	Corrective Action Taken
Year 10 Oil-water Separator Inspection (5/3/07)	Settled solids exceeded the 4-inch maximum thickness allowed; cleaning of all three of the separators necessary.	OWS-01 and OWS-02 cleaned on May 3, 2007 and OWS-03 cleaned on June 20, 2007. All three systems will be cleaned on an annual basis.
Year 10 Site and Stormwater Inspections (6/13/07)	Minor erosion of the north side of the foot path extending approximately 30 feet in length and covering approximately 6 inches of the north side of the foot path.	The northern cutoff drainage system was inspected during a storm event in the second quarter of Year 11 (2008) and was functioning properly; the minor erosion did not impede infiltration of stormwater.
Stormwater Treatment System/Sewage Spill Cleanup (8/17/07)	Approximately 200 gallons of sewage was inadvertently spilled from maintenance activities at a nearby lift station located east of the asphalt-concrete cap, some of which entered CB-2.	Asphalt-concrete cap was cleaned the following day. All settled solids and liquids in CB-2 were removed by City of Bainbridge Island vactor truck, and catch basin insert was replaced. A Kitsap County Health Department spill report was filed and spill prevention procedures were developed.
Asphalt-Concrete Cap Wet Spot Investigation (September 2007 through December 2009)	Several wet spots appeared on asphalt in northern portion of parking lot during dry weather on August 17, 2007, suggesting a subsurface source.	Asphalt patches were applied to wet spots. One patch was removed and protected from runoff for observation, and spots have remained dry. Water lines and artesian wells were inspected, and no leaks were detected. Area is being inspected weekly.
Fence Damage (10/8/07)	A tree had fallen on the fence along the north property boundary.	The tree was removed and the fence was immediately repaired.
Asphalt Subsidence (2/1/08)	A subsidence in the asphalt occurred near the north side of the WSDOT Maintenance Facility that was approximately 5 feet by 5 feet in area and approximately 8-inches deep due to the rotting and failure of the underlying timber supports.	A 15 foot by 12 foot area of the subsidence was refilled with a sand and gravel mix and repaved in third quarter of Year 11 (2008).
Sewage Spill (2/29/08)	Approximately 150 gallons of sewage was spilled at the nearby lift station, some of which flowed onto the site but did not enter a catch basin.	Asphalt-concrete cap was immediately cleaned.

6. WHOU, Summary of Site and Stormwater Inspections at Eagle Harbor Year 10-14 (2007-2011). (modified From Herrera 2012)

Inspection Event and Date	Potential Problem Observed	Corrective Action Taken
Year 11 Wet Weather Inspection (4/29/08)	Approximately 50 square feet of the footpath was observed to be sloping in the direction of the asphalt-concrete cap, causing stormwater to pool and drain away from the French drain.	The small amount of stormwater draining to the south of the footpath is insufficient to pose a risk to the upland source control systems.
Year 11 Upland and Shoreline Area Inspections (5/6/08)	None	None
Year 12 Wet Weather Inspection (5/6/09)	None	None
Year 12 Upland and Shoreline Area Inspections (5/21/09)	Observed shallow (1/4 to 3/8 inch) cracks in asphalt at approximately 9 locations and deep (1 inch) cracks at 2 locations, but no cracks fully penetrated asphalt.	Cracks were sealed with asphalt on October 3, 2009.
	Settled solids exceeded the 4-inch maximum thickness allowed at OWS-2 and OWS-3; annual cleaning was not conducted in 2008.	OWS-01 cleaned on October 15, 2009, OWS-02 cleaned on October 16, 2009, and OWS-03 cleaned on October 29, 2009.
	Two small (3-inch) holes developed in the asphlat patch located adjacent to Pier A.	*Sand bags and rocks used to support underlying fill material, and holes filled with small rocks and patched with asphalt.*
	Two small (15-inch) diameter and shallow depressions observed with CDF boundary.	*Depressions may have been caused by unreported impact from heavy circular object. Area being monitored. Repaired in June 2011.*
	25-feet of concrete filled geotextile mat exposed in the tidal barrier area.	*No corrective actions planned due to the small portion exposed and good condition of mat.*
Year 13 Wet Weather Inspection (4/21/10)	None	None
Year 13 Upland and Shoreline Area Inspections (5/27/10)	Thin (< 1/4 inch) alligator cracks observed in the traffic lane near the northwest corner of the maintenance building, covering an approximate area of 6 feet by 10 feet.	Cracks will be sealed during the summer of Year 14 (2011) after completion of the Eagle Harbor Maintenance Facility upgrades.
	Oil sheen (0.5 to 1 inch thick) observed in first chamber of OWS-1	OWS-1 cleaned on August 6, 2010. OWS-02 and OWS-03 will be cleaned during Year 14 (2011).

6. WHOU, Summary of Site and Stormwater Inspections at Eagle Harbor Year 10-14 (2007-2011). (modified From Herrera 2012)

Inspection Event and Date	Potential Problem Observed	Corrective Action Taken
	Sediment deposition observed in CB-3 and CB-4 due to construction activities associated with the Eagle Harbor Maintenance Facility upgrades.	CB-3 and CB-4 cleaned on August 6, 2010.
Year 14 Wet Weather Inspection (5/11/11)	Five small pools (diameter <10 feet) observed near the monitoring wells and edge of CDF.	Two low spots and a depression surrounding CB-4 (not observed during annual inspection) were filled with asphalt by Peninsula Paving during the summer of Year 14 (2011). Additional low spots will be filled during the summer of Year 15 (2012).
Year 14 Upland and Shoreline Area Inspections (5/16-17/11)	Thin (< 1/4 inch) alligator cracks observed in the traffic lane near the northwest corner of the maintenance building, covering an approximate area of 6 feet by 10 feet.	Alligator cracks sealed BY Peninsula Paving in June 2011.
	Eleven cracks observed along construction joints and patch seams north of the maintenance building up to 51 feet long and 0.25 to 1.5 inches in depth.	Cracks sealed by WSF staff in June 2011.

7. WHOU, Piezometer Water Level Monitoring Results (from Herrera 2012)

Monitoring Event	Date	Time	Tide (ft MLLW)	PZ-02 Depth to Water (feet)	PZ-03 Depth to Water (feet)	PZ-02 Water Level (ft MLLW)	PZ-03 Water Level (ft MLLW)
Tidal Cycle Studya	8/6-11/98	--	7.4	5.89	5.29	9.28	9.33
Tidal Cycle Studya	8/6/1998		7.4	5.89	5.29	9.28	9.33
Fourth Quarter 1998	12/2/1998	17:45	7.6	4.51	4.76	10.66	9.86
First Quarter 1999	1/28/1999	16:20	7.2	5.13	4.59	10.04	10.03
First Quarter 1999	1/28/1999	22:10	0	4.94	4.49	10.23	10.13
Subsidence Inspection	4/7/1999	13:35	4	5.53	4.92	9.64	9.7
Second Quarter 1999	6/15/1999	9:00	5.3	5.32	5.3	9.85	9.32
Second Quarter 1999	6/15/1999	15:00	0.1	5.22	5.31	9.95	9.31
Third Quarter 1999	8/10/1999	8:00	2.8	5.61	5.34	9.56	9.28
Third Quarter 1999	8/10/1999	13:32	2.3	5.43	5.16	9.74	9.46
Fourth Quarter 1999	11/22/1999	18:10	7.2	5.11	5.13	10.06	9.49
Fourth Quarter 1999	11/22/1999	23:40	-0.3	5.03	4.91	10.14	9.71
Second Quarter 2000	6/2/2000	9:30	0.3	5.73	5.38	9.44	9.24
Second Quarter 2000	6/2/2000	14:30	2.8	5.69	5.24	9.48	9.38
Fourth Quarter 2000	12/11/2000	20:05	2.6	5.45	5.42	9.72	9.2
Fourth Quarter 2000	12/11/2000	23:25	-2.8	5.33	5.32	9.84	9.3
Second Quarter 2001	5/24/2001	9:05	4.4	5.81	5.51	9.36	9.11
Second Quarter 2001	5/24/2001	15:30	2.7	5.83	5.57	9.34	9.05
Fourth Quarter 2001	12/13/2001	17:05	9.2	5.05	4.58	10.12	10.04
Fourth Quarter 2001	12/13/2001	23:30	-0.6	4.89	4.48	10.28	10.14
Second Quarter 2002	6/11/2002	9:46	1.1	5.75	5.21	9.42	9.41
Second Quarter 2002	6/11/2002	13:27	-1	5.75	5.2	9.42	9.42
Fourth Quarter 2002	12/2/2002	19:10	2	5.14	5.1	10.03	9.52
Fourth Quarter 2002	12/2/2002	21:20	-1.9	5.12	5.04	10.05	9.58
Third Quarter 2003	7/14/2003	9:05	2.5	5.08	5.16	10.09	9.46
Third Quarter 2003	7/14/2003	13:41	-1.5	5.08	5.04	10.09	9.58
Fourth Quarter 2003	12/8/2003	20:42	1.6	4.89	4.85	10.28	9.77
Fourth Quarter 2003	12/9/2003	22:00	0.3	4.94	4.69	10.23	9.93
Second Quarter 2004	5/19/2004	9:40	2.1	5.62	5.33	9.55	9.29
Second Quarter 2004	5/19/2004	13:54	0.8	5.69	5.27	9.48	9.35
Fourth Quarter 2004	12/9/2004	19:00	1.2	5.29	5	9.88	9.62
Fourth Quarter 2004	12/9/2004	22:46	0.7	5.01	5.12	10.16	9.5
Second Quarter 2005	5/24/2005	9:01	2.6	5.16	5.15	10.01	9.47
Second Quarter 2005	5/24/2005	15:35	4.4	5.06	4.84	10.11	9.78
Fourth Quarter 2005	11/30/2005	19:32	2.1	5.66	5.5	9.51	9.12
Fourth Quarter 2005	11/30/2005	22:55	0.4	5.72	5.4	9.45	9.22
Second Quarter 2006	6/13/2006	10:31	0.3	5	5.17	10.17	9.45
Second Quarter 2006	6/13/2006	13:12	-3.1	5.1	4.99	10.07	9.63
Second Quarter 2007	6/13/2007	8:14	-0.3	5.37	5.4	9.8	9.22
Second Quarter 2007	6/13/2007	14:33	6.6	5.27	5.16	9.9	9.46
Fourth Quarter 2007	12/20/2007	17:55	1.3	4.76	5.1	10.41	9.52
Fourth Quarter 2007	12/20/2007	22:28	2	4.77	4.77	10.4	9.85
Second Quarter 2011	5/17/2011	8:10	4.2	5.14	5.15	10.03	9.47
Second Quarter 2011	5/17/2011	13:54	1.3	5.05	4.84	10.12	9.78
					min	***9.28***	***9.05***
					max	***10.66***	***10.14***

8. WHOU, Water Quality Monitoring Data, 2006-2011

Monitoring Location	Media	Date	Discharge (gpm)	Stream Discharge (cfs)	Tempe-rature (°C)	pH (unit)	Dissolved oxygen (mg/L)	Conduct-ivity (mS/cm)	Salinity (part per thousand)	Turbidity (NTU)	Total suspended solids (mg/L)	Copper, dissolved (µg/L)	Zinc, dissolved (µg/L)	Mercury, dissolved (ng/L)	Mercury, total (ng/L)
Marine Critieria - Acute [a]			–	–	13	7.0 -8.5	>7.0 [c]	–	–	–	–	4.8	90	1,800	–
Marine Criteria - Chronic [a]			–	–	–	–	–	–	–	–	–	3.1	81	–	25
Baseline UPI [b]			–	–	–	–	–	–	–	–	–	6.6	21.1	–	–
Baseline Seep Monitoring															
SP-11	Seep	10/05/06	2.0	–	14.4	7.16	4.3	34.8	21.8	2.0	4.5	2.42	2.65 J	–	–
SP-16	Seep	10/04/06	1.0	–	14.9	7.14	0.8	40.4	25.8	1.4	2.6	5.05	2.2 J	–	–
SP-23	Seep	10/05/06	1.2	–	15.1	7.10	4.9	43.4	28.0	7.0	34	1.36	17.3	–	–
SP-11	Seep	6/13/2007	2.4	–	***14.8***	7.63	***6.4***	35.1	22.2	2	4.1	***5.35***	2.18	–	–
SP-18	Seep	6/13/2007	1.2	–	***14.6***	7.5	***3.1***	37.6	23.9	1.2	5	***6.33***	4.97	–	–
SP-23	Seep	6/13/2007	1.7	–	***19.1***	7.64	7.6	40.4	25.9	6.7	28	1.5	7.9	–	–
SP-14	Seep	12/20/2007	2.0	–	8.8	7.26	***6.1***	37.3	23.5	0.4	3.4J	***5.08***	18.6	–	–
SP-22	Seep	12/20/2007	1.6	–	8.1	7.34	***5.5***	41	26	15.5	52	1.66	11.9	–	–
SP-10	Seep	05/06/08	1.6	–	11.3	7.02	6.6	38.5	24.5	1.0	–	3.684	19.63	–	–
SP-11	Seep	05/06/08	3.0	–	11.3	7.23	6.8	40.0	25.5	1.5	–	2.932	8.155	–	–
SP-23	Seep	05/06/08	1.6	–	12.2	7.34	7.3	43.6	28.1	15	–	2.079	9.564	–	–
SP-24	Seep	05/06/08	1.2	–	14.1	7.43	7.1	42.8	27.5	100	–	1.435	4.512	–	–
PS-03	PS	6/13/2007	–	–	***15.1***	8.31	13.8	41.8	26.9	4.4	–	1.04	1.79	–	–
RS-01	Stream	6/13/2007	–	0.66	***14.7***	8.19	11.6	18.2	10.8	10.1	–	0.78	2.44	–	–
RS-01	Stream	12/20/2007	–	2.4	6.1	7.56	12.1	7.5	4.1	111	–	1.89	5.8	–	–
RS-01	Stream	5/6/2008	–	0.64	11.2	7.59	9.8	15.6	9.8	65	–	1.16	2.74	–	–
RS-03	Stream	6/13/2007	–	0.4	12.5	8.35	11.5	1.09	0.5	6.5	–	0.76	0.88	–	–
RS-03	Stream	12/20/2007	–	2.1	5.8	8.07	13	0.3	0.2	7.8	–	1.98	7.54	–	–
RS-03	Stream	5/6/2008	–	0.4	10.4	8.13	8.1	0.83	0.4	7.1	–	0.928	1.45	–	–
Long-Term Seep Monitoring															
SP-12	Seep	5/17/2011	9.7	–	11.9	7.42	***6.2***	28.5	17.6	1.1	–	***5.38***	6.44	–	–
SP-18	Seep	5/17/2011	1.2	–	***13.7***	7.68	***5.4***	26.7	16.4	7.2	–	2.3	3.98	–	–
SP-24	Seep	5/17/2011	2.4	–	***17.6***	7.58	***5.1***	40	25.6	21	–	1.66	4.53	–	–
Groundwater Monitoring															
MW-01	GW	6/13/2007	–	–	***14.7***	7.41	8.8	40.3	25.8	1	3.1	2.5	2.96	3.78	4.34
MW-01	GW	5/17/2011	–	–	11.6	7.42	7.7	39.7	25.3	0.7	–	2.07	1.81 J	3.34	3.85

NOTES:

[a] Surface water quality standards for extraordinary marine waters in Washington (WAC 173-201A, update 7/1/2003)

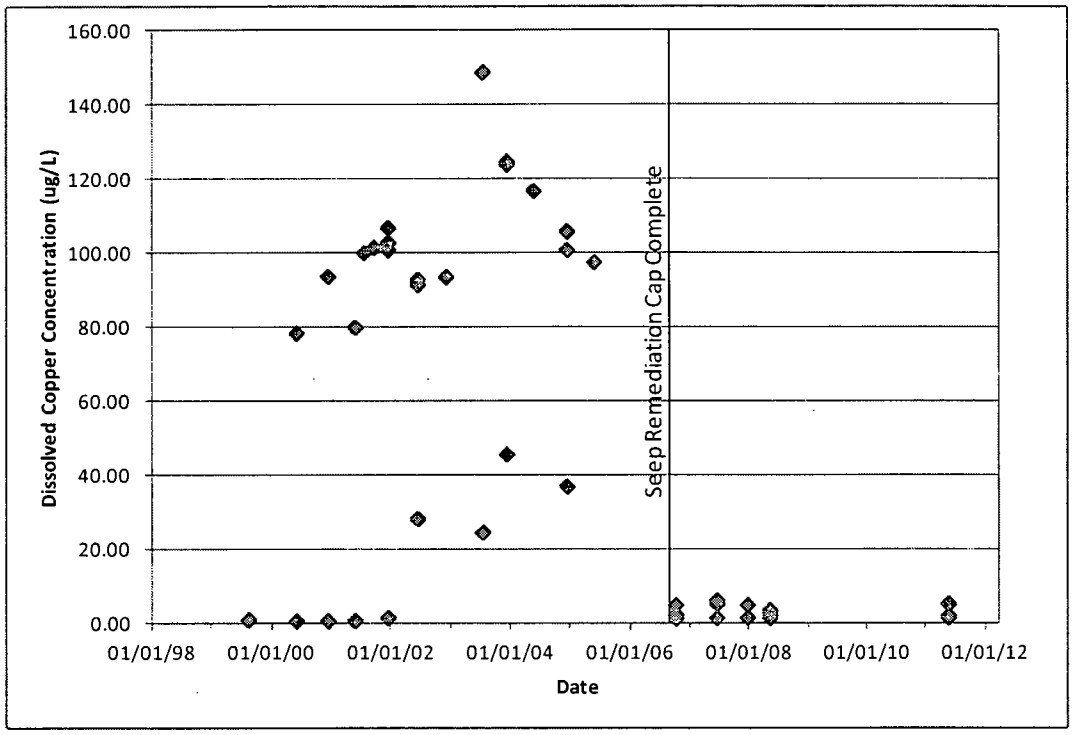
[b] Exceedance of the baseling upper prediction interval (UPI) and the acute criterion by one seep sample requires additional sampling (Herrera 2008b,2009)

[c] Dissolved oxygen criteria do not apply to seep stations because low dissolved oxygen is a goal of seep remediaction to reduce metals solubility.

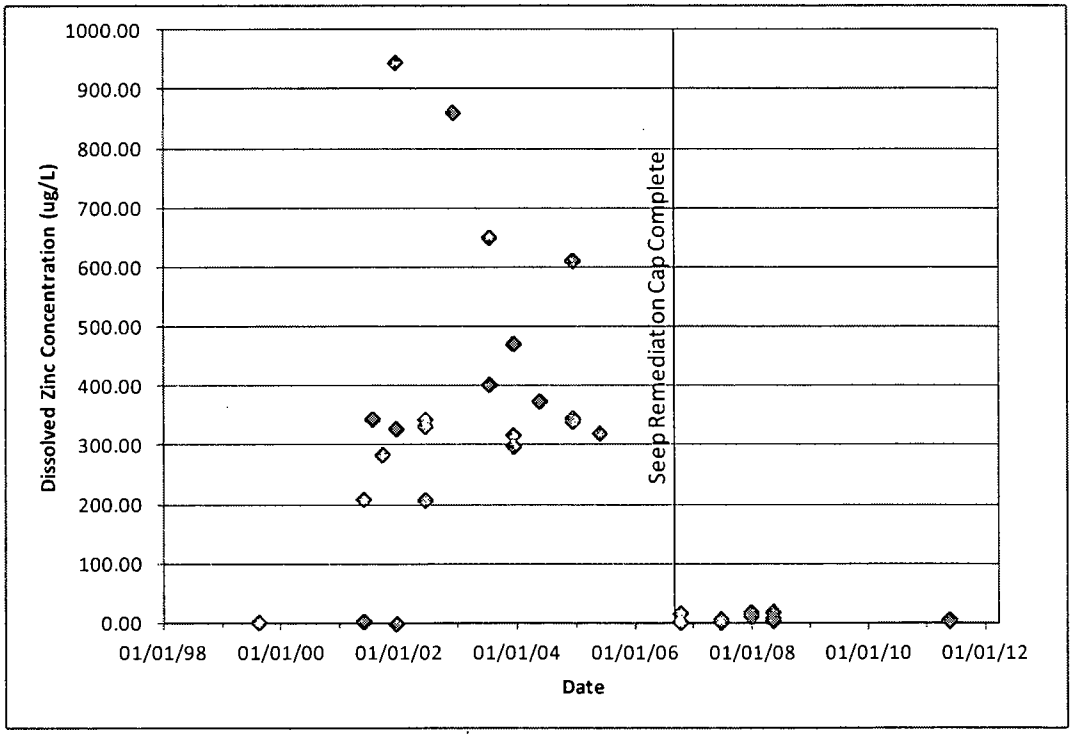
PS - Puget Sound Background

J - esimated

9. WHOU. Metal concentrations at seep monitoring locations.



WHOU. Dissolved copper concentrations at seep monitoring locations.



WHOU. Dissolved zinc concentrations at seep monitoring locations.

10. Subtidal Cap Thickness Comparisons Over Time

Station	Total Cap Thickness 2011 Coring (ft)	Phase II/III Cap Thickness 2003 Coring (ft)	Phase I Cap Thickness 2003 Coring (ft)	Total Cap Thickness 2003 Coring (ft)	Phase I Cap Thickness 1999 Coring (ft)	Phase I Cap Thickness 1997 Coring (ft)
F-7	1.21	0.00	1.02	1.02	1.67	0.98
H-9	4.04	3.58	1.64	5.22	2.56	1.48
I-9	4.89	3.84	1.18	5.02	1.57, 1.61[1]	1.15
G-8	1.80	1.18	0.85	2.03	1.51	1.15
H-10	>5.81	3.05	1.87	4.92	0.52, 0.52[1]	1.48
H-10b		4.20	1.90	6.10	0.52, 0.52[1]	1.48
I-10	5.10	2.43	0.33	2.76	---[2]	---[2]
I-8	1.20	0.00	2.10	2.10	1.64	1.31

[1] Results from two cores

[2] "---" no core at this location

11. Subtidal Cap Surface Sediment Monitoring Results

	SQS (mg/kg OC)	MCUL (mg/kg OC)	LAET (µg/kg dry weight)	2LAET (µg/kg dry weight)	Station ID / Blind ID																															
					H-4 100511007		G-4 100511008		H-5 100611009		H-5 DUPLICATE 100611010		I-5 100611011		I-4 100611012		J-4 100611013		J-3 100611014		M-3 100711002		L-2 100711003		H-2 100711004		F-7 10311002		F-9 10311003							
Conventionals (%)																																				
Total Solids (%)					69.2	—	72.0	—	73.5	—	72.9	—	74.8	—	63.1	—	70.8	—	70.8	—	66.7	—	56.1	—	71.8	—	58.9	—	57.1	—						
Total Organic Carbon (%)					1.8	—	1.5	—	1.21	—	1.6	—	0.99	—	2.7	—	1.9	—	2.0	—	1.8	—	3.0	—	2.1	—	2.4	—	2.5	—						
Grain Size (%)																																				
Particle/Grain Size, Gravel (> 2 mm) (%)					1	—	5.2	—	0.3	—	0.2	—	1	—	0.7	—	0.9	—	85.2	—	0.1	—	2.8	—	0.3	—	0.3	—	0.1	—						
Particle/Grain Size, Sand (0.063 - < 2 mm) microns (%)					78.9	—	66.4	—	88	—	87.7	—	93.6	—	73.9	—	84.5	—	6.9	—	72.8	—	64.1	—	89.1	—	54.8	—	51.2	—						
Particle/Grain Size, Silt (0.007 - < 0.063 mm) (%)					12.2	—	19.1	—	6	—	6	—	2.5	—	15.7	—	8.3	—	7.4	—	14.9	—	17.3	—	4.5	—	29.2	—	33.4	—						
Particle/Grain Size, Clay (< 0.007 mm) (%)					7.9	—	9.1	—	5.6	—	6	—	2.9	—	9.8	—	6.2	—	7.4	—	12.2	—	15.6	—	6	—	16	—	15.4	—						
					Result µg/kg	Q	Result mg/kg OC	Q	Result µg/kg	Q	Result mg/kg OC	Q	Result µg/kg	Q	Result mg/kg OC	Q	Result µg/kg	Q	Result mg/kg OC	Q	Result µg/kg	Q	Result mg/kg OC	Q	Result µg/kg	Q	Result mg/kg OC	Q	Result µg/kg	Q	Result mg/kg OC	Q	Result µg/kg	Q	Result mg/kg OC	Q	Result µg/kg	Q	Result mg/kg OC
PAHs																																				
Naphthalene	99	170	2,100	2,100	1,500		85		5,200		354		78		6.3		46		2.9		28		3.2		720		27		180		9.7		180		9.1		140		8.0		540		18.1		110		5.2		66		2.7		170		6.9	
2-Methylnaphthalene	38	64	670	670	200	J	11		1,200		82		22		1.8		19		1.2		10		1.1		180		6.6		44		2.4		58		2.9		48		2.7		170		5.7		44		2.1		18	J	0.7		52	J	2.1	
1-Methylnaphthalene	—	—	—	—	890		51		1,500		102		55		4.4		110		6.9		20		2.3		180		6.6		70		3.8		57		2.9		150		8.5		120		4.0		43		2.0		45		1.9		33		1.3	
Acenaphthylene	66	66	1,300	1,300	44		3		81		6		9.8		0.8		9	U	0.6		5	U	0.5		48		1.8		12		0.6		21		1.1		21		1.2		60		2.0		9		0.4		25		1.0		20		0.8	
Acenaphthene	16	57	500	500	940		53		4,600		313		45		3.6		41		2.6		15		1.7		200		7.4		69		3.7		160		8.1		38		2.2		160		5.4		54		2.6		17		0.7		26		1.1	
Fluorene	23	79	540	540	1,300		74		3,700		252		64		5.2		61		3.8		20		2.3		240		8.9		66		3.5		220		11		52		3.0		250		8.4		66		3.1		28		1.2		41		1.7	
Phenanthrene	100	480	1,500	1,500	2,800		159		13,000		884		310		25		270		17		72		8.1		770		28		240		13		990		50		190		11		1,100		37		240		11		100		4.1		130		5.3	
Anthracene	220	1,200	960	960	1,000		57		1,100		75		120		9.7		70		4.4		36		4.1		290		11		55		3.0		1,100		56		91		5.2		570		19		250		12		77		3.2		67		2.7	
LPAH	370	780	5,200	5,200	7,584		431		27,681		1,863		627		51		497		31		176		20		2,268		84		622		33		2,671		136		532		30		2,680		90		729		35		313		13		454		18	
Fluoranthene	160	1,200	1,700	2,500	3,100	J	176		8,300	J	565		440		35		380		24		100		11		5,100		188		350		19		2,500		127		280		16		1,400		47		410		20		200	J	8.2		160	J	6.5	
Pyrene	1,000	1,400	2,600	3,300	3,000		170		6,300		429		530		43		520		33		130		15		8,000		295		460		25		2,700		137		450		26		2,600		87		440		21		420	J	17		320	J	13	
Benzo(a)anthracene	110	270	1,300	1,600	520		30		1,200		82		140		11		120		7.5		33		3.7		1,300		48		120		6.5		550		28		150		8.5		650		22		180		9		160		6.6		130		5.3	
Chrysene	110	460	1,400	2,800	990	J	22		810	J	55		150		12		130		8.1		33		3.7		960		35		110		5.9		400		20		190		11		740		25		240		11		220	J	9.1		180	J	7.3	
Benzo(b)fluoranthene	—	—	—	—	310		18		370		25		88		7.1		91		5.7		27		3.0		470		17		86		4.6		260		13		180		10		470		16		94		4.5		170		7.0		170		6.9	
Benzo(k)fluoranthene	—	—	—	—	310		18		370		25		88		7.1		91		5.7		27		3.0		470		17		86		4.6		260		13		180		10		470		16		94		4.5		170		7.0		170		6.9	
Total Benzofluoranthenes	230	450	3,200	3,600	620		35		750		51		180		15		180		11		54		6.1		940		35		170		9.1		520		26		360		20		950		32		190		9.0		340		14		350		14	
Benzo(a)pyrene	99	210	1,600	1,600	260		15		320		22		62		5.0		58		3.6		20		2.3		420		15		67		3.6		210		11		140		8		410		14		66		3.1		170		7.0		130		5.3	
Indeno(1,2,3-cd)pyrene	34	88	600	690	46		2.6		49		3.3		23		1.9		23		1.4		6.6		0.7		98		3.6		21		1.1		43		2.2		48		2.7		160		5.4		20		1.0		66		2.7		58		2.3	
Dibenz(a,h)anthracene	12	33	230	230	30		1.7		31		2.1		12		1.0		10		0.6		4.7	U	0.5		66		2.4		12		0.6		28		1.4		26		1.5		96		3.2		12		0.6		34		1.4		28		1.1	
Benzo(g,h,i)perylene	31	78	670	720	41		2.3		40		2.7		22		1.8		22		1.4		6.1		0.7		90		3.3		22		1.2		41		2.1		51		2.9		170		5.7		19		0.9		63		2.6		56		2.3	
HPAH	960	5,300	12,000	17,000	8,007		455		17,800		1,211		1,559		126		1,443		90		387		44		16,974		626		1,332		72		6,992		355		1,695		96		7,176		241		1,577		75		1,673		69		1,412		57	
Miscellaneous Extractables																																				
Dibenzofuran	15	58	540	540	1,300		74		3,300		224		60		4.8		54		3.3		21		2.4		240		8.9		71		3.8		200		10.2		67		3.8		250		8.4		70		3.3		29		1.2		50		2.0	
Phenols																																				
Pentachlorophenol	360	690	ny	ny	24	U	—		23	U	—		49	U	—		47	U	—		24	U	—		24	U	—		24	U	—		24	U	—		24	U	—		24	U	—		24	U	—		24	U	—		25	U	—		24	U	—	

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

≥ MCUL
≥ SQS

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit, concentration estimated

UJ = Analyte not detected, reporting limit estimated

11. Subtidal Cap Surface Sediment Monitoring Results

	SQS (mg/kg OC)	MCUL (mg/kg OC)	LAET (µg/kg dry weight)	2LAET (µg/kg dry weight)	Station ID / Blind ID: G-9 / 100311005				G-8 / 100411001				H-9 / 100411002				I-8 / 100411007				F-10 / 100311004				H-10 / 100411003				I-10 / 100411004				I-10 DUPLICATE / 100411005				I-9 / 100411006				J-11 / 100511004				C-9 / 10311001			
Conventionals (%)																																															
Total Solids (%)					68.1		—		65.9		—		78.0		—		51.4		—		80.1		—		84.1		—		62.5		—		59.8		—		78.3		—		82.3		—		43.0		—	
Total Organic Carbon (%)					2.2		—		1.8		—		1.2		—		2.6		—		1.1		—		0.5		—		2.7		—		2.9		—		1.5		—		0.9		—		1.9		—	
Grain Size (%)																																															
Particle/Grain Size, Gravel (> 2 mm) (%)					1.6		—		12.5		—		3.9		—		0.1	U	—		3.5		—		10.9		—		20.6		—		17		—		51.2		—		59.5		—		0.1	U	—	
Particle/Grain Size, Sand (0.063 - < 2 mm) microns (%)					70.5		—		49.7		—		18.5		—		5.3		—		43.9		—		73.7		—		45.9		—		46.2		—		29.8		—		28		—		15.2		—	
Particle/Grain Size, Silt (0.007 - < 0.063 mm)(%)					18.2		—		29.1		—		19.2		—		26.3		—		17.5		—		13.6		—		23.8		—		27.7		—		15.7		—		10.5		—		61.6		—	
Particle/Grain Size, Clay (< 0.007 mm) (%)					9.7		—		8.9		—		5.4		—		20.7		—		3.6		—		2		—		9.9		—		9		—		3.1		—		1.8		—		23.4		—	
					Result µg/kg	Q	Result mg/kg OC		Result µg/kg	Q	Result mg/kg OC		Result µg/kg	Q	Result mg/kg OC		Result µg/kg	Q	Result mg/kg OC		Result µg/kg	Q	Result mg/kg OC		Result µg/kg	Q	Result mg/kg OC		Result µg/kg	Q	Result mg/kg OC		Result µg/kg	Q	Result mg/kg OC		Result µg/kg	Q	Result mg/kg OC		Result µg/kg	Q	Result mg/kg OC		Result µg/kg	Q	Result mg/kg OC	
PAHs																																															
Naphthalene	99	170	2,100	2,100	45		2.0		68		3.7		22		1.9		70		2.7		13		1.2		6.9		1.5		54		2.0		50		1.7		15		1.0		20		2.3		72		3.9	
2-Methylnaphthalene	38	64	670	670	19	J	0.9		26	J	1.4		8	J	0.6		22	J	0.8		4.7	J	0.4		4.6		1.0		18	J	0.7		16	J	0.5		5.2	J	0.3		4.6	U	0.5		19	J	1.0	
1-Methylnaphthalene	—	—	—	—	72		3.3		75		4.1		12		1.0		140		5.4		5.2		0.5		4.6		1.0		46	J	1.7		120	J	4.1		8.6		0.6		14		1.0		58		3.1	
Acenaphthylene	66	66	1,300	1,300	10		0.5		16		0.9		7		0.6		12		0.5		6.2		0.6		4.6		1.0		12		0.5		9.7		0.3		6.2		0.4		4.6	U	0.5		22		1.2	
Acenaphthene	16	57	500	500	13		0.6		15		0.8		7		0.6		14		0.5		5.2		0.5		4.6	UJ	1.0		10		0.4		9.7		0.3		6.2		0.4		8.4		1.0		12		0.6	
Fluorene	23	79	540	540	16		0.7		24		1.3		12		1.0		21		0.8		8.0		0.7		6.9	J	1.5		22		0.8		16		0.5		79.0		5.3		9.7		1.1		29		1.6	
Phenanthrene	100	480	1,500	1,500	60		2.7		85		4.6		35		3.0		66		2.5		31		2.8		24		5.3		58		2.2		57		1.9		220.0		15		22		2.5		100		5.4	
Anthracene	220	1,200	960	960	35		1.6		58		3.2		32		2.8		58		2.2		18		1.6		7.8		1.7		49		1.8		52		1.8		250		17		18		2.0		80		4.3	
LPAH	370	780	5,200	5,200	179		8.1		269		15		115		10		241		9		81		7.3		55		12		205		7.7		194		6.6		576		38		83		9.4		315		17	
Fluoranthene	160	1,200	1,700	2,500	100	J	4.5		150	J	8.2		59	J	5.1		110	J	4.2		50	J	4.5		32		7.1		100	J	3.8		86	J	2.9		52	J	3.5		31	J	3.5		190	J	10	
Pyrene	1,000	1,400	2,600	3,300	190	J	8.6		290	J	16		110	J	9.5		240	J	9.2		77	J	6.9		36		8.0		210	J	7.9		160	J	5.5		84	J	5.6		43	J	4.9		340	J	18	
Benzo(a)anthracene	110	270	1,300	1,600	59		2.7		120		6.6		45		3.9		83		3.2		31		2.8		14		3.1		79		3.0		66		2.3		46		3.1		19		2.2		160		8.6	
Chrysene	110	460	1,400	2,800	89	J	4.0		160	J	8.7		62	J	5.3		130	J	5.0		41	J	3.7		29		6.4		130	J	4.9		100	J	3.4		110	J	7.3		47	J	4.2		250	J	13	
Benzo(b)fluoranthene	—	—	—	—	82		3.7		130		7.1		55		4.7		100		3.8		45		4.0		39		8.6		110		4.1		90		3.1		48		3.2		19		2.2		210		11	
Benzo(k)fluoranthene	—	—	—	—	82		3.7		130		7.1		55		4.7		100		3.8		45		4.0		39		8.6		110		4.1		90		3.1		48		3.2		19		2.2		210		11	
Total Benzofluoranthenes	230	450	3,200	3,600	160		7.3		260		14		110		9.5		200		7.7		89		7.9		78	J	17.3		210		7.9		180		6.1		96		6.4		38		4.3		410		22	
Benzo(a)pyrene	99	210	1,600	1,600	65		3.0		110		6.0		46		4.0		85		3.3		36		4.2		14	J	3.1		88		3.3		70		2.6		38		2.5		16		1.8		170		9.1	
Indeno(1,2,3-cd)pyrene	34	88	600	690	28		1.3		43		2.3		19		1.6		31		1.2		18		1.6		16	J	3.5		38		1.4		32		1.1		15		1.0		6.5		0.7		79		4.2	
Dibenz(a,h)anthracene	12	33	230	230	14		0.6		23		1.3		10		0.8		17		0.7		9.5		0.8		8.7	J	1.9		18		0.7		17		0.6		8		0.5		4.6	U	0.5		40		2.2	
Benzo(g,h,i)perylene	31	78	670	720	28		1.3		42		2.3		19		1.6		40		1.2		17		1.5		12	J	2.7		38		1.4		33		1.1		16		1.1		6.5		0.7		79		4.2	
HPAH	960	5,300	12,000	17,000	733		33.3		1,198		65		480		41		926		36		369		33		240		53		911		34.2		750		26		465		31		202		23		1,718		92	
Miscellaneous Extractables																																															
Dibenzofuran	15	58	540	540	22		1.0		30		1.6		14		1.2		22		0.8		9.0		0.8		5.1	J	1.1		23		0.9		18		0.6		25		1.7		10		1.1		23		1.2	
Phenols																																															
Pentachlorophenol	360	690	ns	ns	24	U	—		24	U	—		24		—		24	U	—		24	U	—		23		5.1		24	U	—		24	U	—		24	U	—		23	U	—		24		—	

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene.

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

SAMPLE
2 SQS

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit, concentration estimated

UJ = Analyte not detected, reporting limit estimated

12. Subtidal Cap Subsurface Sediment Monitoring Results

Parameter	SQS (mg/kg OC)	MCUL (mg/kg OC)	LAET (µg/kg dry weight)	2LAET (µg/kg dry weight)	Phase I Cap - North																Phase I Cap - Central											
					Station ID / Blind ID																												
					H-2 (Primary) 102011005			I-3 (Primary) 101911012			I-5 (Primary) 101911015			J-2 (Primary) 102011013			J-2 (Field Duplicate Primary) 102011012			J-4 (Primary) 102011010			F-7 (Primary) 102011026			F-9 (Primary) 102011024			G-8 (Shallow) 102011020			G-8 (Primary) 102011021			I-8 (Primary) 102011002		
					106.7 - 123.4 cm bms			39.6 - 56.4 cm bms			304.8 - 323.1 cm bms			57.9 - 76.2 cm bms			57.9 - 76.2 cm bms			10.1 - 21.3 cm bms			10.1 - 21.3 cm bms			10.7 - 30.7 cm bms			10.1 - 24.4 cm bms			24.4 - 38.1 cm bms			6.1 - 24.4 cm bms		
Conventionals (%)																																	
Total Solids (%)					81.1		---	66.9		---	92.3			76.4		---	75.3		---	72.1		---	67.5		---	71.9		---	74.5		---	74		---	61.8		---
Total Organic Carbon (%)					1.5		---	4.7		---	0.5			0.8		---	1.8		---	1.9		---	2.2		---	1.5		---	1.6		---	2.0		---	2.0		---
Grain Size (%)																																	
Particle/Grain Size, Gravel (> 2 mm)					2.4		---	2.8		---	30.3			0.6		---	0.4		---	0.1		---	0.4		---	12		---	20.1		---	2.3		---	0.2		---
Particle/Grain Size Sand (0.063 mm - < 2 mm)					77.3		---	83.7		---	49.2			93.1		---	91.7		---	76.8		---	71.7		---	57.9		---	53.1		---	85.2		---	64.5		---
Particle/Grain Size, Silt (0.007 mm - < 0.063 mm)					13.8		---	6.7		---	18.4			3.5		---	4.9		---	14.7		---	18		---	23.6		---	21.0		---	9.4		---	23.9		---
Particle/Grain Size, Clay (<0.007 mm)					6.4		---	6.9		---	0.8			2.9		---	3		---	8.4		---	10		---	6.4		---	5.9		---	3.2		---	11.7		---
					Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q		Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC
PAHs																																	
Naphthalene	99	170	2,100	2,100	95		6.4	300		6.4	7.8			120		15	110		6.3	64		3.4	200		9.2	99		6.6	69		4.4	340		17	240		12
2-Methylnaphthalene	38	64	670	670	22	J	1.5	80		1.7	4.8	U		49		5.9	38		2.2	31		1.6	67		3.1	28		1.9	17		1.1	26		1.3	88		4.4
1-Methylnaphthalene	---	---	---	---	17	J	1.1	68		1.5	14			71	U	8.6	100	U	5.7	38	U	2.0	130	U	6.0	85	U	5.7	14		0.9	120	U	6.0	51		2.5
Acenaphthylene	66	66	1,300	1,300	24		1.6	12		0.3	4.8	U		3.3	J	0.4	12		0.7	24	U	1.3	24		1.1	16	J	1.1	12		0.8	13	U	0.6	29		1.4
Acenaphthene	16	57	500	500	20	J	1.4	72		1.5	4.8	U		27		3.3	37		2.1	24		1.3	76		3.5	82		5.5	18		1.1	3,600		179	42		2.1
Fluorene	23	79	540	540	27		1.8	78		1.7	4.8	U		22		2.7	20		1.1	28		1.5	91		4.2	100		6.7	21		1.3	2,400		119	59		2.9
Phenanthrene	100	480	1,500	1,500	95		6.4	110		2.4	4.4	J		37		4.5	35		2.0	64		3.4	270		12	340		23	120		7.6	12,000		597	130		6.5
Anthracene	220	1,200	960	960	68		4.6	63		1.3	4.8	U		9.9		1.2	14		0.8	21	J	1.1	110		5.0	71		4.7	56		3.5	1,200		60	73		3.6
LPAH	370	780	5,200	5,200	256		17	415		8.9	28			148		18	156		8.9	192		10	638		29	637		42	244		15	19,239		957	421		21
Fluoranthene	160	1,200	1,700	2,500	83		5.6	280		6.0	4.8	U		22		2.7	31		1.8	62		3.3	250		11	210		14	230		15	10,000		498	150		7.5
Pyrene	1,000	1,400	2,600	3,300	200		14	1,100		24	3.9	J		300		36	160		9.1	280		15	560		26	370		25	300		19	6,600		328	670		33
Benzo(a)anthracene	110	270	1,300	1,600	54		3.6	170		3.6	4.8	U		7.6		0.9	33		1.9	21	J	1.1	120		5.5	75		5.0	94		5.9	1,500		75	81		4.0
Chrysene	110	460	1,400	2,800	66		4.5	140		3.0	4.8	U		15		1.8	38		2.2	26		1.4	170		7.8	120		8.0	160		10	1,200		60	150		7.5
Benzo(b)fluoranthene	---	---	---	---	120		8.1	130		2.8	4.8	U		25		3.0	30		1.7	43		2.3	210		9.6	94		6.3			0	430		21	210		10.4
Benzo(k)fluoranthene	---	---	---	---	120		8.1	130		2.8	4.8	U		25		3.0	30		1.7	43		2.3	210		9.6	94		6.3			0	430		21	210		10.4
Total Benzofluoranthenes	230	450	3,200	3,600	250		17	260		5.6	4.8	U		50		6.1	60		3.4	86		4.6	430		20	190		13	290		18	860		43	430		21
Benzo(a)pyrene	99	210	1,600	1,600	110		7.4	100		2.1	4.8	U		18		2.2	42		2.4	28		1.5	160		7.3	78		5.2	110	J	7.0	360		18	140		7.0
Indeno(1,2,3-cd)pyrene	34	88	600	690	44		3.0	24		0.5	4.8	U		4.7		0.6	14		0.8	24	U	1.3	62		2.8	26		1.7	41		2.6	66		3.3	61		3.0
Dibenz(a,h)anthracene	12	33	230	230	29		2.0	14		0.3	4.8	U		4.7	U	0.6	5.6		0.3	24	U	1.3	33		1.5	16	J	1.1	22		1.4	43		2.1	22	J	1.1
Benzo(g,h,i)perylene	31	78	670	720	54	J	3.6	21	J	0.4	4.8	UJ		5.2	J	0.6	16	J	0.9	24	UJ	1.3	69	J	3.2	28	J	1.9	40		2.5	59	J	2.9	68	J	3.4
HPAH	960	5,300	12,000	17,000	890		60	2,109		45	42			427		52	400		23	575		30	1,854		85	1,113		74	1,287		81	20,688		1,029	1,772		88
Miscellaneous Extractables																																	
Dibenzofuran	15	58	---	---	32		2.2	73		1.6	4.8	U		46		5.6	27		1.5	26		1.4	79		3.6	78		5.2	22		1.4	920		46	71		3.5
Phenols																																	
Pentachlorophenol	360	690	---	---	120	U	8.1	24	U	0.5	24	U		24	U	2.9	23	U	1.3	120	U	6.3	120	U	5.5	120	U	8.0	24	U		63	U	3.1	120	U	6.0

bms = below mud surface

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

≥ MCUL
≥ SQS

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit; concentration estimated

UJ = Analyte not detected, reporting limit estimated

12. Subtidal Cap Subsurface Sediment Monitoring Results

Parameter	SQS (mg/kg OC)	MCUL (mg/kg OC)	LAET (µg/kg dry weight)	2LAET (µg/kg dry weight)	Phase II/III Cap											
					Station ID Blind ID											
					H-9 (Primary) 102011016			H-9 (Field Duplicate Primary) 102011018			H-10 (Primary) 102011008		I-9 (Primary) 101911024		I-10 (Primary) 101911020	
					85.3 - 105.2 cm bms			85.3 - 105.2 cm bms			134.1 - 155.4 cm bms		121.9 - 135.6 cm bms		120.4 - 137.2 cm bms	
Conventionals (%)																
Total Solids (%)					71.9		---	72.3		---	95.1		91.5		89.6	
Total Organic Carbon (%)					1.9		---	2.4		---	0.1		0.1		0.1	
Grain Size (%)																
Particle/Grain Size, Gravel (> 2 mm)					0.5		---	0.5		---	56.7		29		35.8	
Particle/Grain Size Sand (0.063 mm - < 2 mm)					78.6		---	80.7		---	31.3		46.3		45.7	
Particle/Grain Size, Silt (0.007 mm - < 0.063 mm)					14.4		---	12.5		---	11.9		23.7		17.5	
Particle/Grain Size, Clay (<0.007 mm)					6.3		---	6.3		---	0.1	U	1.1		0.8	
					Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q
PAHs																
Naphthalene	99	170	2,100	2,100	120		6.2	72		3.0	4.7	U	4.6	U	4.6	U
2-Methylnaphthalene	38	64	670	670	42		2.2	31		1.3	4.7	U	4.6	U	4.6	U
1-Methylnaphthalene	---	---	---	---	200	U	10.3	140	U	5.9	4.7	U	4.6	U	4.6	U
Acenaphthylene	66	66	1,300	1,300	14	J	0.7	24	U	1.0	4.7	U	4.6	U	4.6	U
Acenaphthene	16	57	500	500	44		2.3	34		1.4	4.7	U	4.6	U	4.6	U
Fluorene	23	79	540	540	56		2.9	38		1.6	4.7	U	4.6	U	4.6	U
Phenanthrene	100	480	1,500	1,500	98		5.1	74		3.1	4.7	U	3.2	J	2.8	J
Anthracene	220	1,200	960	960	28		1.4	24		1.0	4.7	U	4.6	U	4.6	U
LPAH	370	780	5,200	5,200	282		15	225		9.4	28.2		26.2		25.8	
Fluoranthene	160	1,200	1,700	2,500	75		3.9	70		2.9	4.7	U	4.6	U	4.6	U
Pyrene	1,000	1,400	2,600	3,300	170		8.8	150		6.3	4.7	U	4.6	U	4.2	J
Benzo(a)anthracene	110	270	1,300	1,600	26		1.3	29		1.2	4.7	U	4.6	U	4.6	U
Chrysene	110	460	1,400	2,800	35		1.8	38		1.6	4.7	U	4.6	U	2.8	J
Benzo(b)fluoranthene	---	---	---	---	36		1.9	32		1.3	4.7	U	4.6	U	1.8	J
Benzo(k)fluoranthene	---	---	---	---	36		1.9	32		1.3	4.7	U	4.6	U	1.8	J
Total Benzofluoranthenes	230	450	3,200	3,600	72		3.7	65		2.7	4.7	U	4.6	U	3.7	J
Benzo(a)pyrene	99	210	1,600	1,600	23		1.2	24		1.0	4.7	U	4.6	U	4.6	U
Indeno(1,2,3-cd)pyrene	34	88	600	690	23	U	1.2	24	U	1.0	4.7	U	4.6	U	4.6	U
Dibenz(a,h)anthracene	12	33	230	230	23	U	1.2	24	U	1.0	4.7	U	4.6	U	4.6	U
Benzo(g,h,i)perylene	31	78	670	720	16	J	0.8	24	UJ	1.0	4.7	UJ	4.6	UJ	4.6	UJ
HPAH	960	5,300	12,000	17,000	463		24	448		19	42		41		38	
Miscellaneous Extractables																
Dibenzofuran	15	58	---	---	49		2.5	36		1.5	4.7	U	4.6	U	4.6	U
Phenols																
Pentachlorophenol	360	690	---	---	120	U	6.2	120	U	5.0	24	U	23	U	23	U

bms = below mud surface

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene.

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

≥ MCUL

≥ SQS

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit, concentration estimated

UJ = Analyte not detected; reporting limit estimated

13. J-9 and J-10 Surface Sediment Monitoring Results

Parameter	SQS	MCUL	LAET (µg/kg dry weight)	2LAET (µg/kg dry weight)	Station ID / Blind ID: J-9a 100611002			J-9b 100611003			J-9b DUPLICATE 100611004			J-9c 100611005			J-10a 100611006			J-10b 100611007			J-10c 100611008		
Conventionals (%)																									
Total Solids (*a)					83.5		—	58.6		—	57.0		—	55.0		—	76.1		—	50.8		—	80.8		—
Total Organic Carbon (*a)					0.6		—	2.3		—	1.6		—	2.0		—	1.4		—	2.7		—	0.7		—
Grain Size (%)																									
Particle/Grain Size, Gravel (> 2 mm)					47.6		—	21.8		—	19.6		—	7.6		—	26.6		—	14.2		—	52.5		—
Particle/Grain Size Sand (0.063 mm - < 2 mm)					35.3		—	43.2		—	45.8		—	57.6		—	46.3		—	51.3		—	30		—
Particle/Grain Size, Silt (0.007 mm - < 0.063 mm)					13.4		—	26.3		—	26.6		—	20.4		—	22		—	24.9		—	15.9		—
Particle/Grain Size, Clay (< 0.007 mm)					1.7		—	8.7		—	9.0		—	14.4		—	4.9		—	9.5		—	1.4		—
Metals	(mg/kg)	(mg/kg)																							
Arsenic	57	93	—	—	8	U	—	8	U	—	9	U	—	10	U	—	6	U	—	10	U	—	5	U	—
Cadmium	5.1	6.7	—	—	0.2	U	—	0.5		—	0.5		—	0.5		—	0.3	U	—	1.3		—	0	+ U	—
Chromium	260	270	—	—	17.7		—	33.8		—	32.7		—	41.0		—	27.3		—	34.0		—	16.3		—
Copper	390	390	—	—	14.0		—	37.4		—	39.1		—	45.7		—	23.3		—	49.5		—	16.1		—
Lead	450	530	—	—	3		—	11		—	12		—	12		—	5		—	12		—	3		—
Mercury	0.41	0.59	—	—	0.03	U	—	0.10		—	0.09		—	0.1		—	0.06		—	0.12		—	0.02	U	—
Silver	6.1	6.1	—	—	0.4	U	—	0.5	U	—	0.5	U	—	0.6	U	—	0.4	U	—	0.6	U	—	0.3	U	—
Zinc	410	960.0	—	—	30		—	59		—	61		—	70		—	39		—	80		—	31		—
					Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC
PAHs	mg/kg OC	mg/kg OC																							
Naphthalene	99	170	2,100	2,100	75		12	200		9.0	160		10	55		4.9	65		4.5	360		14	11		1.5
2-Methylnaphthalene	38	64	670	670	24		3.8	58		2.6	49		3.1	33		1.7	27		1.9	94		3.5	5		0.6
Acenaphthylene	66	66	1,300	1,300	16		2.5	42		1.9	40		2.5	61		3.1	14		1.0	32		1.2	5		0.6
Acenaphthene	16	57	500	500	21		3.8	48		2.2	41		2.6	31		1.6	10		1.1	98		3.6	5		0.6
Fluorene	23	110	540	540	31		4.9	72		3.2	59		3.7	58		3.0	25		1.7	96		3.6	5		0.6
Phenanthrene	100	480	1,500	1,500	130		21	240		11	200		13	240		12	66		4.6	320		12	18		2.5
Anthracene	220	1,200	960	960	79	J	12	170	J	7.7	150	J	12	360	J	18	230	J	16	230	J	8.5	15	J	2.1
LPAH	370	780	5,200	5,200	355		56	772		35	690		43	845		43	416		29	1,158		43	58		8.0
Fluoranthene	160	1,200	1,700	2,500	230		36	300		14	320		20	450		23	97		6.7	440		16	24		3.3
Pyrene	1,000	1,400	2,600	3,300	410		65	980		44	1,000		63	2,300		118	200		14	1,200		44	46		6.3
Benzo(a)anthracene	110	270	1,300	1,600	160		25	290		13	250		16	960		49	67		4.7	290		11	17		2.3
Chrysene	110	460	1,400	2,800	330	J	52	530		24	460		29	1,300		67	92		6.4	390		14	27		3.7
Benzo(b)fluoranthene	—	—	—	—	240		—	420		—	380		—	850		—	100		—	380		—	30		—
Benzo(k,g)fluoranthene	—	—	—	—	240		—	420		—	380		—	850		—	100		—	380		—	30		—
Total Benzofluoranthenes	230	450	3,200	3,600	490		77	840		38	760		48	1,700		87	210		14.6	760		28	61		8.4
Benzo(e)pyrene	99	210	1,600	1,600	170	J	27	320	J	14	310	J	19	570	J	29	85	J	5.9	260	J	9.6	22	J	3.0
Indeno(1,2,3-cd)pyrene	34	88	600	690	66		10	130		5.6	110		6.9	220		11	34		2.4	98		3.6	12		1.7
Dibenz(a,h)anthracene	12	33	230	230	32		5	67		3.0	62		3.9	120		6.2	18		1.3	53		2.0	5		0.7
Benzo(g,h,i)perylene	31	78	670	720	62		10	130		5.6	110		6.9	200		10	36		2.5	93		3.4	14		1.9
HPAH	960	5,300	12,000	17,000	1,950		308	3,587		162	3,382		213	7,820		401	839		58	3,582		133	228		31
Chlorinated Hydrocarbons (See Note)	mg/kg OC	mg/kg OC																							
1,3-Dichlorobenzene	2.3	2.3	35	50	18	U	2.8	20	U	0.9	20	U	1.3	20	U	1.0	20	U	1.4	77	U	2.9	19	U	2.6
1,4-Dichlorobenzene	3.1	9	110	220	18	U	2.8	20	U	0.9	20	U	1.3	20	U	1.0	20	U	1.4	77	U	2.9	19	U	2.6
1,2,4-Trichlorobenzene	0.81	1.8	31	51	18	U	2.8	20	U	0.9	20	U	1.3	20	U	1.0	20	U	1.4	77	U	2.9	19	U	2.6
Hexachlorobutadiene	3.9	6.2	120	270	9	UJ	1.5	10	UJ	0.4	10	UJ	0.6	10	UJ	0.5	10	UJ	0.7	38	UJ	1.4	9	UJ	1.3
Hexachlorobenzene	0.38	2.3	0.022	0.07	18	U	2.8	20	U	0.9	20	U	1.3	20	U	1.0	20	U	1.4	77	U	2.9	19	U	2.6
Phthalates	mg/kg OC	mg/kg OC																							
Dimethylphthalate	53	53	71	160	18	U	2.8	20	U	0.9	20	U	1.3	20	U	1.0	20	U	1.4	77	U	2.9	19	U	2.6
Diethylphthalate	61	110	97	97	46	U	7.3	50	U	2.3	49	U	3.1	49	U	2.5	49	U	3.4	190	U	7.0	46	U	6.3
Di-n-Butylphthalate	220	1,700	1,400	1,400	18	U	2.8	20	U	0.9	20	U	1.3	20	U	1.0	20	U	1.4	100		3.7	19	U	2.6
Butylbenzylphthalate	4.9	64	63	47	18	U	2.8	20	U	0.9	20	U	1.3	20	U	1.0	20	U	1.4	77	U	2.9	19	U	2.6
bis(2-Ethylhexyl)phthalate	47	78	1,900	1,900	27	U	4.3	36	U	1.6	29	U	1.8	47	U	2.4	24	U	1.7	96	U	3.6	23	U	3.2
Di-n-Octyl phthalate	58	4,500	—	—	18	U	2.8	20	U	0.9	20	U	1.3	20	U	1.0	20	U	1.4	77	U	2.9	19	U	2.6
Miscellaneous Extractables	mg/kg OC	mg/kg OC																							
Dibenzofuran	15	58	540	540	32		5.0	85		3.8	65		4.1	94		2.6	28		1.9	120		4.4	7		1.0
N-Nitrosodiphenylamine	11	11	40	63	18	U	2.8	20	U	0.9	20	U	1.3	20	U	1.0	20	U	1.4	77	U	2.9	19	U	2.6
Phenols	µg/kg	µg/kg																							
Phenol	420	1,200	420	560	89	J	—	23	J	—	32	J	—	44	J	—	20	U	—	200	J	—	27	J	—
2-Methylphenol	63	63	63	63	18	U	—	20	U	—	20	U	—	18	J	—	20	U	—	77	U	—	19	U	—
4-Methylphenol	670	670	670	1,200	56		—	49		—	51		—	91		—	39	U	—	140	J	—	23	J	—
2,4-Dimethylphenol	29	29	29	29	18	J	—	20	J	—	20	UJ	—	20	J	—	20	J	—	76	J	—	19	J	—
Pentachlorophenol	360	690	—	—	23	U	—	74	U	—	74	U	—	24	U	—	24	U	—	24	U	—	23	U	—
Benzyl Alcohol	57	73	57	73	18	U	—	20	U	—	20	U	—	20	U	—	20	U	—	77	U	—	19	U	—
Benzoic Acid	650	65	650	650	370	U	—	400	U	—	400	U	—	390	U	—	390	U	—	390	J	—	370	U	—

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(e)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

> SQS (*1)
> SQS

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit; concentration estimated

UJ = Analyte not detected; reporting limit estimated

U = Reporting limit exceeds a threshold

Note: To be consistent with the laboratory reporting format, all non-detected analytes were reported as non-detected at the RLs for this project, where in fact the analytes were non-detected at or near the method detection limits (MDLs). The MDLs for 1,2-dichlorobenzene, 1,2,4-trichlorobenzene, and hexachlorobenzene were approximately 10 times) lower than their respective RLs. The organic-carbon-normalized detection limits (using the MDLs) were thereby significantly and met the SQS criteria

14. J-9 and J-10 Subsurface Sediment Monitoring Results

Parameter	SQS[1]	MCUL	LAET (ppb dry weight)	2LAET (ppb dry weight)	Station ID / Blind ID	J-9a (Primary) 101811002			J-9b (Primary) 101711009			J-9b (Shallow) 101711009			J-9c (Primary) 101711001			J-10a (Primary) 101811010			J-10b (Primary) 101811012			J-10c (Primary) 101911002			J-10c (Shallow) 101911001		
						10 - 24 cm bms			130 - 148 cm bms			108- 130 cm bms			292 - 308 cm bms			50 - 70 cm bms			10 - 24 cm bms			104 - 119 cm bms			89 - 104 cm bms		
Conventionals (%)																													
Total Solids (%)									67.1		---	44.7			90.9			91.5			79.1		--	93.6			93.4		
Total Organic Carbon (%)									2.7		---	0.1			0.1			0.0			0.0		--	0.1			4.3		
Grain Size																													
Particle/Grain Size, Gravel (> 2 mm)									---		---	21.1			---			---			---		---	---			53.8		
Particle/Grain Size, Sand (0.063 mm - < 2 mm)									---		---	18.8			---			---			---		---	---			31.6		
Particle/Grain Size, Silt (0.007 mm - < 0.063 mm)									---		---	46.6			---			---			---		---	---			14.1		
Particle/Grain Size, Clay (< 0.007 mm)									---		---	13.4			---			---			---		---	---			0.4		
Metals	(mg/kg)	(mg/kg)																											
Arsenic	57	93	---	---					7.0	U	---	10	U		5.0	U		5.0	U		6.0	U	---	5.0	U		5	U	---
Cadmium	5.1	6.7	---	---					0.6		---	2.1			0.2	U		0.2	U		0.3		---	0.2	U		0.2	U	---
Chromium	260	270	---	---					33		---	46			31			23			19		---	29			17		---
Copper	390	390	---	---					23		---	75			17			15			21		---	15			13		---
Lead	450	530	---	---					15		---	53			2	U		2.0	U		4.0		---	2.0			2	U	---
Mercury	0.41	0.59	---	---					0.2		---	0.7	J		0.0	U		0.0	U		0.0		---	0.0	U		0.02	U	---
Silver	6.1	6.1	---	---					0.4	U	---	0.7	U		0.3	U		0.3	U		0.4	U	---	0.3	U		0.3	U	---
Zinc	410	960	---	---					38		---	94			30			29			36		---	30			20		---
PAHs						Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC
Naphthalene	99	170	2,100	2,100		10.000		3.69	12,000		444	27		1.4	14		0.5	590		63	130		36	36		0.9			
2-Methylnaphthalene	38	64	670	670		2.100		0.78	1,400		52	4.6		0.2	5.3		0.2	140		15	72		20	10	J	0.2			
Acenaphthylene	66	66	1,300	1,300		470		0.17	580		21	4.6	U	0.2	3.4	J	0.1	12	J	1.3	17		4.7	20	U	0.5			
Acenaphthene	16	57	500	500		18.000		6.67	19,000		704	21		1.0	5.8		0.2	85		9.0	89		25	60		1.4			
Fluorene	23	79	540	540		35.000		12.96	34,000		1,259	28		1.2	7.2		0.3	94		10	79		22	52		1.2			
Phenanthrene	100	480	1,500	1,500		10.000		3.70	21,000		778	100		4.3	17		0.7	220		23	1,900		535	540		13			
Anthracene	220	1,200	960	960		42.000		15.56	27,000		1,000	14		0.6	15		0.6	110		12	470		132	110		2.6			
Total LPAH	370	780	5,200	5,200		121,470		45.00	113,500		4,204	195		8.4	62		2.5	1,111		118	2,665		750	818		20			
Fluoranthene	160	1,200	1,700	2,500		120,000		44.44	98,000		3,630	46	J	2.0	440		17.6	780		83	6,400		1,803	1,600		38			
Pyrene	1,000	1,400	2,600	3,300		93,000		34.44	57,000		2,111	41		1.8	480		19.2	1,500		159	4,100		1,155	1,100		26			
Benzo(a)anthracene	110	270	1,300	1,600		19,000		7.04	7,100		263	7.8		0.3	74		3.0	200		21	730		206	240		5.7			
Chrysene	110	460	1,400	2,800		17,000	J	6.30	7,600		281	8.2	J	0.3	47	J	1.9	190	J	20	540	J	152	230		5.5			
Benzo(b)fluoranthene	---	---	---	---		5,400		2.00	---		---	3.0	J	0.1	35		1.4	130		14	170		48	---		---			
Benzo(k)fluoranthene	---	---	---	---		5,400		2.00	---		---	3.0	J	0.1	35		1.4	130		14	170		48	---		---			
Total Benzofluoranthenes	230	450	3,200	3,600		11,000		4.07	11,000		407	5.9		0.2	69		2.8	260		28	340		96	160		3.8			
Benzo(a)pyrene	99	210	1,600	1,600		4,900		1.81	5,900		219	4.6	U	0.2	29		1.2	110		12	130		37	77		1.8			
Indeno(1,2,3-cd)pyrene	34	88	600	690		1,000		0.37	1,900		70	4.6	U	0.2	7.7		0.3	30		3.2	29		8.2	20		0.5			
Dibenz(a,h)anthracene	12	33	230	230		640		0.24	600		22	4.6	U	0.2	2.4	J	0.1	14		1.5	20		5.7	11	J	0.3			
Benzo(g,h,i)perylene	31	78	670	670		1,200		0.44	900		33	4.6	U	0.2	7.7		0.3	30		3.2	29	J	8.2	19	J	0.5			
Total HPAH	960	5,300	12,000	17,000		256,710		94.74	195,300		7,244	123		5.1	1,078		43.1	2,854		302	12,839		3,597	3,297		79			
Chlorinated Hydrocarbons	mg/kg OC	mg/kg OC																											
1,2-Dichlorobenzene	2.3	2.3	35	50		56	U	20.7	21	U	0.8	18	U	0.8	20	U	0.8	19	U	2.1	21	U	5.9	18	U	0.8	20	U	0.5
1,4-Dichlorobenzene	3.1	9	110	220		56	U	20.7	21	U	0.8	25	U	1.0	20	U	0.8	19	U	2.1	21	U	5.9	18	U	0.8	20	U	0.5
1,2,4-Trichlorobenzene	0.81	1.8	31	51		56	U	20.7	21	U	0.8	18	U	0.7	20	U	0.8	19	U	2.1	20	U	5.6	18	U	0.8	20	U	0.5
Hexachlorobutadiene	3.9	6.2	120	270		260	U	96.3	10	U	0.4	9.8	UJ	0.4	9.5	UJ	0.4	9.5	UJ	1.0	10	U	2.8	9.1	UJ	0.4	99	U	2.4
Hexachloroethane	0.38	2.3	0.022	0.67		56	U	20.7	21	U	0.8	18	U	0.7	20	U	0.8	19	U	2.1	20	U	5.6	18	U	0.8	20	U	0.5
Phthalates	mg/kg OC	mg/kg OC																											
Dimethylphthalate	53	53	71	160		56	U	20.7	21	U	0.8	13	J	0.5	20	U	0.8	19	U	2.1	20	U	5.6	18	U	0.8	20	U	0.5
Diethylphthalate	61	110	97	97		140	U	51.8	42	U	1.6	52		2.0	47	U	1.8	47	U	5.0	46	U	13.1	44	U	1.9	49	U	1.2
Di-n-Butylphthalate	220	1,700	1,400	1,400		56	U	20.7	21	U	0.8	18	U	0.7	20	U	0.8	19	U	2.1	20	U	5.6	18	U	0.8	20	U	0.5
Butylbenzylphthalate	4.9	64	63	47		56	U	20.7	21	U	0.8	18		0.7	20	U	0.8	19	U	2.1	20	U	5.6	18	U	0.8	20	U	0.5
bis(2-Ethylhexyl)phthalate	47	78	1,900	1,900		71	U	26.3	24	U	0.9	39	U	1.5	24	U	1.0	24	U	2.7	24	U	6.7	23	U	1.0	25	U	0.6
Di-n-Octylphthalate	58	4,500	---	---		56	U	20.7	21	U	0.8	20		0.8	20	U	0.8	19	U	2.1	20	U	5.6	18	U	0.8	20	U	0.5
Miscellaneous Extractables	mg/kg OC	mg/kg OC																											
Dibenzofuran	15	58	540	540		7,200		2667	4,200		156	26		1.0	9.6		0.4	140		14.8	24		6.7	20		0.5			
N-Nitrosodiphenylamine	3.9	11	40	63		1,200	J	444	110		4.1	14	J	0.5	20	U	0.8	19	U	2.1	20	U	5.6	18	U	0.8	20	U	0.5
Phenols	µg/kg	µg/kg																											
Phenol	420	1,200	420	560		120		---	410		---	26	J	---	20	U	---	19	U	---	---		---	18	U	---	20	U	---
2-Methylphenol	63	63	63	63		390		---	250		---	18	U	---	20	U	---	19	U	---	---		---	18	U	---	20	U	---
4-Methylphenol	670	670	670	1,200		370	J	---	1,100		---	36	U	---	39	U	---	17	J	---	---		---	36	U	---	40	U	---
2,4-Dimethylphenol	29	29	29	29		1,200		---	4,100		---	36	U	---	20	UJ	---	12	J	---	---		---	18	UJ	---	40	U	---
Pentachlorophenol	360	690	---	---		980	U	---	190	U	---	23	UJ	---	24	U	---	72	U	---	---		---	51	U	---	200	U	---
Benzyl Alcohol	57	73	57	73		56	U	---	12	U	---	18	U	---	20	U	---	19	U	---	---		---	18	U	---	20	U	---
Benzoic Acid	650	650	650	650		610	J	---	380	U	---	360	U	---	390	U	---	380	U	---	---		---	360	U	---	400	U	---

bms = below mud surface

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

1 LAET
2 2LAET
3 MCUL
4 SQS

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit, concentration estimated

UJ = Analyte not detected, reporting limit estimated

[illegible] = Reporting limit exceeds criterion

15 University of Texas sediment results

Comparison of porewater concentrations detected using SPME and grab sample methods

	Naphthalene			Acenaphthene			Phenanthrene		
Site	GS	SPME	logRatio	GS	SPME	logRatio	GS	SPME	logRatio
I-8				0.073	0.038	0.28	0.16	0.011	1.18
I-9									
I-10							0.14	0.013	1.03
I-10 Duplicate							0.13	0.013	0.99
G-8	2.76	1.27	0.34	0.11	0.629	0.75	0.30	0.072	0.62
J-9a	8.68	0.072	2.08						
J-9b	6.57	0.072	1.96						
J-9b Duplicate	7.34	0.072	2.01						
J-9c	3.55	0.072	1.70						
H-9	1.34	0.090	1.17	0.079	0.075	0.02	0.19	0.020	0.97
G-9	1.49	0.069	1.33	0.080	0.036	0.35	0.17	0.018	0.98
F-9				0.14	0.063	0.35	0.33	0.10	0.53
	Anthracene			Fluoranthene			Pyrene		
	GS	SPME	logRatio	GS	SPME	logRatio	GS	SPME	logRatio
I-8				0.072	0.022	0.51	0.14	0.041	0.54
I-9				0.059	0.0047	1.09	0.087	0.0093	0.97
I-10				0.063	0.010	0.82	0.12	0.0082	1.17
I-10 Duplicate				0.050	0.010	0.72	0.086	0.0082	1.02
G-8	0.19	0.012	1.21	0.14	0.028	0.71	0.25	0.036	0.84
J-9a	0.75	0.029	1.42	0.62	0.064	0.99	1.01	0.51	0.30
J-9b	0.46	0.029	1.21	0.23	0.064	0.56	0.69	0.51	0.13
J-9b Duplicate	0.72	0.029	1.40	0.34	0.064	0.73	0.98	0.51	0.28
J-9c	1.11	0.029	1.59	0.39	0.064	0.79	1.84	0.51	0.55
H-9				0.083	0.021	0.61	0.14	0.017	0.92
G-9				0.077	0.018	0.64	0.13	0.026	0.72
F-9				0.11	0.015	0.86	0.20	0.024	0.92
	Chrysene			Benz[a]anthracene			Benzo[b]fluoranthene		
	GS	SPME	logRatio	GS	SPME	logRatio	GS	SPME	logRatio
I-8	0.023	0.00039	1.77	0.013	0.0014	0.96	0.014	0.0028	0.70
I-9	0.034	0.00029	2.08	0.013	0.00045	1.45	0.012	0.00083	1.16
I-10	0.022	0.00034	1.82	0.012	0.00041	1.47	0.015	0.00077	1.29
I-10 Duplicate	0.016	0.00034	1.68	0.0094	0.00041	1.36	0.012	0.00077	1.17
G-8				0.027	0.0012	1.37	0.027	0.0013	1.32
J-9a	0.24	0.0015	2.21	0.105	0.0064	1.21	0.14	0.0072	1.29
J-9b	0.11	0.0015	1.87	0.054	0.0064	0.92	0.0702	0.0072	0.99
J-9b Duplicate	0.13	0.0015	1.96	0.065	0.0064	1.01	0.089	0.0072	1.09
J-9c	0.31	0.0015	2.32	0.203	0.0064	1.50	0.16	0.0072	1.35
H-9	0.024	0.00043	1.75	0.015	0.00091	1.23	0.017	0.0011	1.21
G-9	0.019	0.00039	1.68	0.011	0.00084	1.12	0.014	0.00094	1.17
F-9	0.034	0.00022	2.18	0.021	0.00054	1.60	0.025	0.0010	1.42
	Benzo[k]fluoranthene			Benzo[a]pyrene					
	GS	SPME	logRatio	GS	SPME	logRatio			
I-8	0.012	0.00063	1.27	0.0093	0.0010	0.96			
I-9	0.010	0.00018	1.75	0.0072	0.00015	1.67			
I-10	0.013	0.00016	1.88	0.0092	0.00013	1.85			
I-10 Duplicate	0.010	0.00016	1.77	0.0074	0.00013	1.76			
G-8	0.022	0.00034	1.82	0.017	0.00029	1.77			
J-9a	0.12	0.0012	2.00	0.076	0.0018	1.63			
J-9b	0.058	0.0012	1.69	0.041	0.0018	1.36			
J-9b Duplicate	0.074	0.0012	1.80	0.055	0.0018	1.49			
J-9c	0.13	0.0012	2.06	0.083	0.0018	1.67			
H-9	0.014	0.00027	1.72	0.011	0.00027	1.60			
G-9	0.011	0.00024	1.69	0.0084	0.00020	1.63			
F-9	0.021	0.00022	1.98	0.015	0.00024	1.79			

16. EBS and Intertidal Cap Surface Sediment Monitoring Results Compared to the SMS

Parameter	SQS (mg/kg OC)	MCUL (mg/kg OC)	LAET (µg/kg dry weight)	2LAET (µg/kg dry weight)	EBS										Intertidal					
					Station ID (Grabs composited) Blind ID															
					F12-D1 102611001		G12-B2 102611002		H12-A2 102611003		G11-A4 102611004		I12-C2 102611005		J11-A5 102611006		J11-D2 102611007		J10-E5 102611008	
Conventionals (%)																				
Total Solids (%)					96.8		96.4		95.2		93.7		92.8		95.7		92.7		94.3	
Total Organic Carbon (%)					0.2		0.2		0.3		0.1		0.1		0.2		0.3		0.3	
Grain Size (%)																				
Particle/Grain Size, Gravel (> 2 mm)					23.9		16.6		12.8		47.2		16.8		53.7		36.3		59.8	
Particle/Grain Size Sand (0.063 mm - < 2 mm)					53.5		68.7		69.4		35.6		62		30.6		46.5		28.8	
Particle/Grain Size, Silt (0.007 mm - < 0.063 mm)					22		14.4		17		16.7		20.2		15		16.1		11	
Particle/Grain Size, Clay (<0.007 mm)					0.6		0.4		0.8		0.6		1.2		0.7		1.1		0.6	
PAHs					**Result µg/kg**	**Q**	**Result µg/kg**	**Q**	**Result µg/kg**	**Q**	**Result µg/kg**	**Q**	**Result µg/kg**	**Q**	**Result µg/kg**	**Q**	**Result µg/kg**	**Q**	**Result µg/kg**	**Q**
Naphthalene	99	170	2,100	2,100	2.8	J	4.7		13.0		4.9	U	7.4		4.7	U	47.0		30	
2-Methylnaphthalene	38	64	670	670	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7	U	9.6		9.2	
1-Methylnaphthalene	---	---	---	---	4.7	U	4.7	U	2.9	J	4.9	U	4.9	U	4.7	U	10.0		6.9	
Acenaphthylene	66	66	1,300	1,300	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7	U	4.6	U	3.7	J
Acenaphthene	16	57	500	500	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7	U	9.2		9.2	
Fluorene	23	110	540	540	4.7	UJ	4.7	UJ	4.8	UJ	4.9	UJ	4.9	UJ	4.7	UJ	6.4	UJ	9.6	J
Phenanthrene	100	480	1,500	1,500	2.8	J	3.3	J	3.8	J	4.9	U	3.0	J	4.7	U	27		36	
Anthracene	220	1,200	960	960	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7	U	11		19	
LPAH	370	780	5,200	5,200	24		27		36		29		30		28		105		108	
Fluoranthene	160	1,200	1,700	2,500	3.7	J	3.8	J	3.8	J	4.9	U	3.4	J	4.7		30.0		46	
Pyrene	1,000	1,400	2,600	3,300	4.7		3.3	J	6.2		4.9	U	3.4	J	6.6		47.0		57	
Benzo(a)anthracene	110	270	1,300	1,600	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.2	J	9.6		18	
Chrysene	110	460	1,400	2,800	3.3	J	2.8	J	4.8	U	4.9	U	3.4	J	13		11		27	
Benzo(b)fluoranthene	---	---	---	---	2.1	J	4.7	U	1.2	J	4.9	U	2.2	J	8.4		6.4		20	
Benzo(k)fluoranthene	---	---	---	---	2.1	J	4.7	U	1.2	J	4.9	U	2.2	J	8.4		6.4		20	
Total Benzofluoranthenes	230	450	3,200	3,600	4.2	J	4.7	U	2.4	J	4.9	U	4.4	J	17		13		40	
Benzo(a)pyrene	99	210	1,600	1,600	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7		4.1	J	18	
Indeno(1,2,3-cd)pyrene	34	88	600	690	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	3.3	J	3.7	J	8.7	
Dibenz(a,h)anthracene	12	33	230	230	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7	U	4.6	U	5.1	
Benzo(g,h,i)perylene	31	78	670	720	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	5.2		4.1	J	11	
HPAH	960	5,300	12,000	17,000	39		38		41		44		39		63		127		231	
Miscellaneous Extractables																				
Dibenzofuran	15	58	540	540	4.7	U	4.7	U	4.8	U	4.9	U	3.0	J	4.7	U	10		12	
Phenols																				
Pentachlorophenol	360	690	nv	nv	23	U	24	U	24	U	24	U	25	U	24	U	23	U	23	U

Note: Results were not OC-normalized because TOC less than 0.5%.

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene.

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit; concentration estimated

UJ = Analyte not detected; reporting limit estimated

17. EBS and Intertidal Cap Surface Sediment Results Compared to Human Health Performance Standards as defined in the ROD and ESD

Parameter	Intertidal Sediment Method B Carcinogen Unrestricted Land Use (µg/kg)	Intertidal Sediment Method B, Non-carcinogen, Unrestricted Land Use (µg/kg)	ROD Intertidal Sediment Human Health (µg/kg)	EBS										Intertidal					
				Station ID (grabs composited) Blind ID															
				F12-D1 102611001		G12-B2 102611002		H12-A2 102611003		G11-A4 102611004		I12-C2 102611005		J11-A5 102611006		J11-D2 102611007		J10-E5 102611008	
				Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q
PAHs																			
Naphthalene	---	1,600,000	---	2.8	J	4.7		13.0		4.9	U	7.4		4.7	U	47.0		30	
2-Methylnaphthalene	---	320,000	---	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7	U	9.6		9.2	
1-Methylnaphthalene	---	24,000	---	4.7	U	4.7	U	2.9	J	4.9	U	4.9	U	4.7	U	10.0		6.9	
Acenaphthylene	---	---	---	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7	U	4.6	U	3.7	J
Acenaphthene	---	4,800,000	---	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7	U	9.2		9.2	
Fluorene	---	3,200,000	---	4.7	UJ	4.7	UJ	4.8	UJ	4.9	UJ	4.9	UJ	4.7	UJ	6.4	UJ	9.6	J
Phenanthrene	---	---	---	2.8	J	3.3	J	3.8	J	4.9	U	3.0	J	4.7	U	27		36	
Anthracene	---	24,000,000	---	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7	U	11		19	
LPAH	---	370,000	---	24		27		36		29		30		28		105		108	
Fluoranthene	---	3,200,000	---	3.7	J	3.8	J	3.8	J	4.9	U	3.4	J	4.7		30.0		46	
Pyrene	---	2,400,000	---	4.7		3.3	J	6.2		4.9	U	3.4	J	6.6		47.0		57	
Benzo(a)anthracene	140	---	---	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.2	J	9.6		18	
Chrysene	140	---	---	3.3	J	2.8	J	4.8	U	4.9	U	3.4	J	13		11		27	
Benzo(b)fluoranthene	140	---	---	2.1	J	4.7	U	1.2	J	4.9	U	2.2	J	8.4		6.4		20	
Benzo(k)fluoranthene	140	---	---	2.1	J	4.7	U	1.2	J	4.9	U	2.2	J	8.4		6.4		20	
Benzo(a)pyrene	140	---	---	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7		4.1	J	18	
Indeno(1,2,3-cd)pyrene	140	---	---	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	3.3	J	3.7	J	8.7	
Dibenz(a,h)anthracene	140	---	---	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	4.7	U	4.6	U	5.1	
Benzo(g,h,i)perylene	---	---	---	4.7	U	4.7	U	4.8	U	4.9	U	4.9	U	5.2		4.1	J	11	
HPAH	---	---	1,200	39		43		41		49		39		63		127		231	
Total PAH	1,400	---	---	7		7		7		7		7		8		7		25	
Miscellaneous Extractables																			
Dibenzofuran	15,000	---	---	4.7	U	4.7	U	4.8	U	4.9	U	3.0	J	4.7	U	10		12	
Phenols																			
Pentachlorophenol	8,300	---	---	23	U	24	U	24	U	24	U	25	U	24	U	23	U	23	U

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene.

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

Total PAH = total benzo(a)pyrene equivalents for benzo(a)anthracene, chrysene, benzo(b) and benzo(k)fluoranthenes, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenz(a,h)anthracene

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit; concentration estimated

UJ = Analyte not detected, reporting limit estimated

18. Exposure Barrier System Cover Measure

Location	Grab 1			Grab 2			Grab 3		
	Depth (ft)[1]	Latitude (N)	Longitude (W)	Depth (ft)[1]	Latitude (N)	Longitude (W)	Depth (ft)[1]	Latitude (N)	Longitude (W)
F12-D1	3.1	47 36 59.178	122 30 25.044	2.47	47 36 59.373	122 30 26.163	**0.85**	47 36 58.736	122 30 25.606
G12-B2	2.65	47 36 58.874	122 30 23.715	1.9	47 36 58.672	122 30 22.912	**0.99**	47 36 58.269	122 30 23.698
H12-A2	2.65	47 36 58.481	122 30 20.021	3.3	47 36 58.598	122 30 21.038	1.18	47 36 58.856	122 30 20.799
G11-A4	2.55	47 36 59.871	122 30 24.848	2.9	47 36 59.601	122 30 23.670	2.17	47 36 59.313	122 30 24.464
I12-C2	2.95	47 36 58.557	122 30 14.198	3.15	47 36 58.373	122 30 16.258	2.25	47 36 57.981	122 30 15.594
Beach Measure 01	**0.95**	47 36 57.879	122 30 19.230	---	---	---	---	---	---
Beach Measure 02	1.87	47 36 57.771	122 30 18.072	---	---	---	---	---	---
Beach Measure 03	1.75	47 36 57.309	122 30 18.221	---	---	---	---	---	---
Beach Measure 04	3.21	47 36 58.439	122 30 17.705	---	---	---	---	---	---
Beach Measure 05	**0.75**	47 36 57.475	122 30 15.117	---	---	---	---	---	---
Beach Measure 06	2.95	47 36 58.313	122 30 15.476	---	---	---	---	---	---

[1]Depth = depth-to-refusal of driving a 3/8 inch, 4-ft steel rod. Refusal is assumed to be at the underlying rock layer on the EBS.

Bold indicates depth less than 1.0 foot target depth

19. North Shoal Surface Sediment Monitoring Results Compared to the SMS

Parameter	SQS (mg/kg OC)	MCUL (mg/kg OC)	LAET (µg/kg dry weight)	2LAET (µg/kg dry weight)	Station Id (grabs composited) Blind Id K9-B4 102611009		M9-A3 102811001		L9-D4 102811002		L9-B4 102811003			K9-D3 102811004		
Conventionals (%)																
Total Solids (%)					76.7		77.2		80.1		69.9		---	68.6		---
Total Organic Carbon (%)					0.4		0.2		0.3		1.4		---	0.5		---
Grain Size (%)																
Particle/Grain Size, Gravel (> 2 mm)					5.1		0.5		14.4		0.9		---	0.2		---
Particle/Grain Size Sand (0.063 mm - < 2 mm)					80.2		91.8		75.9		85.7		---	81.2		---
Particle/Grain Size, Silt (0.007 mm - < 0.063 mm)					10.5		5.1		7.2		9.7		---	13.2		---
Particle/Grain Size, Clay (<0.007 mm)					4.2		2.5		2.5		3.8		---	5.5		---
PAHs					**Result µg/kg**	**Q**	**Result µg/kg**	**Q**	**Result µg/kg**	**Q**	**Result µg/kg**	**Q**	**Result mg/kg OC**	**Result µg/kg**	**Q**	**Result mg/kg OC**
Naphthalene	99	170	2,100	2,100	480		43		53		450		32	2,000		**385**
2-Methylnaphthalene	38	64	670	670	120		8.5		15		100		7	420		**81**
1-Methylnaphthalene	---	---	---	---	78		6.8	J	9.2		54		4	320		62
Acenaphthylene	66	66	1,300	1,300	20		8.5	U	2.8	J	9.1		1	55		11
Acenaphthene	16	57	500	500	83		7.6	J	14		70		5	420		**81**
Fluorene	23	110	540	540	90		10	UJ	17	UJ	80	UJ	6	370	UJ	**71**
Phenanthrene	100	480	1,500	1,500	310		24		63		230		17	1,000		**193**
Anthracene	220	1,200	960	960	180		11		30		100		7	590		114
LPAH	370	780	5,200	5,200	1,163		104		180		939		68	4,435		**855**
Fluoranthene	160	1,200	1,700	2,500	770		26		120		210		15	1,300		**250**
Pyrene	1,000	1,400	2,600	3,300	920		73		260		490		35	4,300		829
Benzo(a)anthracene	110	270	1,300	1,600	270		13		37		69		5	700		**135**
Chrysene	110	460	1,400	2,800	460		17		44		79		6	1,000		**193**
Benzo(b)fluoranthene	---	---	---	---	340		17		32		60		4	480		92
Benzo(k)fluoranthene	---	---	---	---	340		17		32		60		4	480		92
Total Benzofluoranthenes	230	450	3,200	3,600	680		34		64		120		9	950		183
Benzo(a)pyrene	99	210	1,600	1,600	210	J	14		28		47		3	430		83
Indeno(1,2,3-cd)pyrene	34	88	600	690	67		6.8	J	13		22		2	170		33
Dibenz(a,h)anthracene	12	33	230	230	35		8.5	U	5.5		8.7		1	84		**16**
Benzo(g,h,i)perylene	31	78	670	720	64		8.5		14		22		2	160		**31**
HPAH	960	5,300	12,000	17,000	3,476		201		586		1,068		77	9,094		**1,752**
Miscellaneous Extractables																
Dibenzofuran	15	58	540	540	110		12		17		120		9	560		**108**
Phenols																
Pentachlorophenol	360	690	nv	nv	23	U	42	U	23	U	24	U	---	23	U	---

Note: Results were not OC-normalized because TOC less than 0.5%.

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene.

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

≥ MCUL

≥ SQS

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit, concentration estimated

UJ = Analyte not detected; reporting limit estimated

UJ = Reporting limit exceeds a threshold

20. North Shoal Surface Sediment Results Compared to Human Health Performance Standards as defined in the ROD and ESD

Parameter	Intertidal Sediment Method B Carcinogen Unrestricted Land Use (µg/kg)	Intertidal Sediment Method B, Non-carcinogen, Unrestricted Land Use (µg/kg)	ROD Intertidal Sediment Human Health (µg/kg)	Station Id (grabs composited) Blind Id K9-B4 102611009 Result µg/kg	Q	M9-A3 102811001 Result µg/kg	Q	L9-D4 102811002 Result µg/kg	Q	L9-B4 102811003 Result µg/kg	Q	K9-D3 102811004 Result µg/kg	Q
PAHs													
Naphthalene	—	1,600,000	—	480		43		53		450		2,000	
2-Methylnaphthalene	—	320,000	—	120		8.5		15		100		420	
1-Methylnaphthalene	—	24,000	—	78		6.8	J	9.2		54		320	
Acenaphthylene	—	—	—	20		8.5	U	2.8	J	9.1		55	
Acenaphthene	—	4,800,000	—	83		7.6	J	14		70		420	
Fluorene	—	3,200,000	—	90		10	UJ	17	UJ	80	UJ	370	UJ
Phenanthrene	—	—	—	310		24		63		230		1,000	
Anthracene	—	24,000,000	—	180		11		30		100		590	
LPAH	—	370,000	—	1,163		104		180		939		4,435	
Fluoranthene	—	3,200,000	—	770		26		120		210		1,300	
Pyrene	—	2,400,000	—	920		73		260		490		4,300	
Benzo(a)anthracene	140	—	—	270		13		37		69		700	
Chrysene	140	—	—	460		17		44		79		1,000	
Benzo(b)fluoranthene	140	—	—	340		17		32		60		480	
Benzo(k)fluoranthene	140	—	—	340		17		32		60		480	
Benzo(a)pyrene	140	—	—	210	J	14		28		47		430	
Indeno(1,2,3-cd)pyrene	140	—	—	67		6.8	J	13		22		170	
Dibenz(a,h)anthracene	140	—	—	35		8.5	U	5.5		8.7		84	
Benzo(g,h,i)perylene	—	—	—	64		8.5		14		22		160	
HPAH	—	—	1,200	2,796		167		522		948		8,144	
Total PAH	1,400	—	—	320		20		40		70		631	
Miscellaneous Extractables													
Dibenzofuran	15,000	—	—	110		12		17		120		560	
Phenols													
Pentachlorophenol	8,300	—	—	23	U	42	U	23	U	24	U	23	U

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene.

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

Total PAH = total benzo(a)pyrene equivalents for benzo(a)anthracene, chrysene, benzo(b) and benzo(k)fluoranthenes, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenz(a,h)anthracene

≥ ROD-Established MTCA Method B, Carcinogen Concentration

≥ ROD Intertidal Sediment Human Health Criterion

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit; concentration estimated

UJ = Analyte not detected; reporting limit estimated

21. East Beach Surface Sediment Monitoring Results Compared to SMS

Parameter	SQS (mg/kg OC)	MCUL (mg/kg OC)	LAET (µg/kg dry weight)	2LAET (µg/kg dry weight)	Station Id / Blind Id: N10-B4 102811005	N11-A5 102711001	N11-B5 102711002	N11-B4 102711003	N11-B3 102711004	N11-B2 102711005	N11-A2 102711006	N11-A1 102711007	N10-A5 102711008	N10-A4 102711009	M10-E4 102711010	N11-C5 102711011	N11-D5 102711012	N11-C4 102711013	N11-C2 102711014	N10-B5 102711015
Conventionals (%)																				
Total Solids (%)					80.8	76.6	71.7	70.7	69.1	68.9	78.6	72.6	73.0	72.6	79.2	73.3	73.5	74.3	81.2	80.2
Total Organic Carbon (%)					0.4	0.3	0.3	0.2	0.1	0.4	0.3	0.3	0.3	0.2	0.3	0.3	0.4	0.2	0.4	0.3
Grain Size (%)																				
Particle/Grain Size, Gravel (> 2 mm)					0.5	28.3	0.1	0.1 U	0.1 U	0.2	3.5	3.3	0.1	0.1 U	17.6	0.1	0.3	0.1 U	0.1	0.7
Particle/Grain Size Sand (0.063 mm - < 2 mm)					92.6	68.7	95.1	91.3	84.8	81.2	85.4	83.8	91.9	94.3	72.8	96.1	96.2	96.3	94.6	89.7
Particle/Grain Size, Silt (0.007 mm - < 0.063 mm)					3.2	0.7	1.7	4.7	11.1	14.8	3.2	9.9	4.2	1.8	7.7	1.6	1.5	1.8	4.4	7.2
Particle/Grain Size, Clay (< 0.007 mm)					3.7	2.1	3	4	4	4	2.7	3.2	3.7	3.8	1.9	2.3	2	1.9	0.1	2.5
					Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q	Result µg/kg Q
PAHs																				
Naphthalene	99	170	2,100	2,100	38	21	10	9.3	35	65	64	46	63	120	150	8.0	26	99	38	160
2-Methylnaphthalene	38	64	670	670	11	4.3 J	4.8 U	2.4 J	9	15	5.0 U	8.3	14	24	27	4.7 U	6.3	31	4.6	24
1-Methylnaphthalene	—	—	—	—	10	7.6	2.9 J	2.4 J	10 U	16	5.0 U	8.3 U	12 U	20 U	26	4.7 U	5.8	41	18	25
Acenaphthylene	66	66	1,300	1,300	3.7 J	4.7 U	4.8 U	4.9 U	3.7 J	3.9 J	5.0 U	5.8	2.8 J	6.3	14	4.7 U	4.8 U	4.7 U	5.1	4.6
Acenaphthene	16	57	500		27	17 J	4.8 UJ	4.9 UJ	6.5 J	15 J	5.0 UJ	7.8 J	15 J	33 J	60 J	4.7 UJ	5.8 J	18 J	11 J	39 J
Fluorene	23	110	540	540	20 UJ	3.8 J	4.8 UJ	4.9 UJ	9.3 J	14 J	2.5 J	8.3 J	9.9 J	39 J	64 J	4.7 UJ	4.8 J	9.4 J	7.0 J	36 J
Phenanthrene	100	480	1,500	1,500	54	25	5.3	4.9	43	58	9.9	23	52	92	210	3.3 J	12	34	52	89
Anthracene	220	1,200	960	960	41	6.6	3.4 J	3.4 J	26	21	5.0	10	16	96	580	4.2 J	4.3 J	7.5	19	41
LPAH	370	780	5,200	5,200	184	78	33	32	124	177	34	101	159	386	1,078	30	58	173	132	370
Fluoranthene	160	1,200	1,700	2,500	74	71	15	12	90	94	20	48	49	340	1,700	16	7.7	37	300	98
Pyrene	1,000	1,400	2,600	3,300	240	100	44	24	130	150	120	130	95	660	2,300	30	31	56	320	240
Benzo(a)anthracene	110	270	1,300	1,600	25	39	6.2	5.4	49	34	7.9	25	19	150	360	3.7 J	3.8 J	6.1	52	34
Chrysene	110	460	1,400	2,800	30	45	5.7	7.3	59	54	9.9	43	35	240	660	8.0	5.3	8.0	75	43
Benzo(b)fluoranthene	—	—	—	—	22	36	6.7	7.3	24	35	7.0	28	19	74	140	6.6	7.0	7.6	68	28
Benzo(k)fluoranthene	—	—	—	—	22	36	6.7	7.3	24	35	7.0	28	19	74	140	6.6	7.0	7.6	68	28
Total Benzofluoranthenes	230	450	3,200	3,600	45	71	13	15	47	70	14	55	38	150	290	13	14	15	140	56
Benzo(a)pyrene	99	210	1,600	1,600	19	39	5.3	3.9 J	26	28	6.0	20	16	55	94	2.8 J	4.3 J	5.2	34	21
Indeno(1,2,3-cd)pyrene	34	88	600	690	9.2	22	3.4 J	4.9 UJ	8.4	18	5.0 UJ	12	10	21	37	4.7 UJ	4.8 UJ	4.7 UJ	15	7.4
Dibenz(a,h)anthracene	12	33	230	230	3.7 J	14 J	4.8 UJ	4.9 UJ	5.1 J	9.8 J	5.0 UJ	7.3 J	3.8 J	14 J	24 J	4.7 UJ	4.8 UJ	4.7 UJ	5.6 J	4.2 J
Benzo(g,h,i)perylene	31	78	670	720	11	26	3.4 J	3.4 J	10	22	3.5 J	13	14	24	95	4.7 UJ	4.3 J	4.7 UJ	15	9.3
HPAH	960	5,300	12,000	17,000	457	427	101	81	425	480	141	353	280	1,654	5,500	88	80	141	957	563
Miscellaneous Extractables																				
Dibenzofuran	15	58	540	540	16	5.7	3.8 J	2.4 J	10	14	3.0 J	11	12	46	47	4.7 U	5.3	24	5.6	44
Phenols																				
Pentachlorophenol	360	690	nv	nv	23 UJ	24 UJ	24 UJ	24 UJ	23 UJ	25.0 UJ	25 UJ	24 UJ	24 UJ	24 UJ	24 UJ	23 UJ	24 UJ	24 UJ	23 UJ	23 UJ

Note: Results were not OC-normalized because TOC less than 0.5%

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

> LAET

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit; concentration estimated

UJ = Analyte not detected, reporting limit estimated

22. East Beach Surface Sediment Results Compared to Human Health Performance Standards as defined in the ROD and ESD

Parameter	Intertidal Sediment Method B Carcinogen Unrestricted Land Use (µg/kg)	Intertidal Sediment Method B, Non-carcinogen, Unrestricted Land Use (µg/kg)	ROD Intertidal Sediment Human Health (µg/kg)	Station ID / Blind ID																													
				N10-B4 102811005		N11-A5 102711001		N11-B5 102711002		N11-B4 102711003		N11-B3 102711004		N11-B2 102711005		N11-A2 102711006		N11-A1 102711007		N10-A5 102711008		N10-A4 102711009		M10-E4 102711010		N11-C5 102711011		N11-D5 102711012		N11-C4 102711013		N11-C2 102711014		N10-B5 102711015	
				Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q
PAHs																																	
Naphthalene	–	1,600,000	–	38		21		10		9.3		35		65		6.4		46		63		120		150		8.0		26		99		38		160	
2-Methylnaphthalene	–	320,000	–	11		4.3	J	4.8	UJ	2.4	J	9		15		5.0	UJ	8.3		14		24		27		4.7	UJ	6.3		31		4.6		24	
1-Methylnaphthalene	–	24,000	–	10		7.6		2.9	J	2.4	J	10	UJ	16		5.0	UJ	8.3	UJ	12	UJ	20	UJ	26		4.7	UJ	5.8		41		18		25	
Acenaphthylene	–	–	–	3.7	J	4.7	UJ	4.8	UJ	4.9	UJ	3.7	J	3.9	J	5.0	UJ	5.8		2.8	J	6.3		14		4.7	UJ	4.8	UJ	4.7	UJ	5.1		4.6	
Acenaphthene	–	4,800,000	–	27		17	J	4.8	UJ	4.9	UJ	6.5	J	15	J	5.0	UJ	7.8	J	15	J	33	J	60	J	4.7	UJ	5.8	J	18	J	11	J	39	J
Fluorene	–	3,200,000	–	20	UJ	3.8	J	4.8	UJ	4.9	UJ	9.3	J	14	J	2.5	J	8.3	J	9.9	J	39	J	64	J	4.7	UJ	4.8	J	9.4	J	7.0	J	36	J
Phenanthrene	–	–	–	54		25		5.3		4.9		43		58		9.9		23		52		92		210		3.3	J	12		34		52		89	
Anthracene	–	24,000,000	–	41		6.6		3.4	J	3.4	J	26		21		5.0		10		16		96		580		4.2	J	4.3	J	7.5		19		41	
LPAH	–	370,000	–	184		78		33		32		124		177		34		101		159		386		1078		30		58		173		132		370	
Fluoranthene	–	3,200,000	–	74		71		15		12		90		94		20		48		49		340		1700		16		77		37		300		98	
Pyrene	–	2,400,000	–	240		100		44		24		130		150		120		130		95		660		2300		30		31		56		320		290	
Benzo(a)anthracene	140	–	–	25		39		6.2		5.4		49		34		7.9		25		19		150		350		3.7	J	3.8	J	6.1		52		34	
Chrysene	140	–	–	30		45		5.7		7.3		59		54		9.9		43		35		240		660		8.0		5.3		8.0		75		43	
Benzo(b)fluoranthene	140	–	–	22		36		6.7		7.3		24		35		7.0		28		19		74		140		6.6		7.0		7.6		68		28	
Benzo(k)fluoranthene	140	–	–	22		36		6.7		7.3		24		35		7.0		28		19		74		140		6.6		7.0		7.6		68		28	
Benzo(a)pyrene	140	–	–	19		39		5.3		3.9	J	26		28		6.0		20		16		55		94		2.8	J	4.3	J	5.2		34		21	
Indeno(1,2,3-cd)pyrene	140	–	–	9.2		22		3.4	J	4.9	UJ	8.4		18		5.0	UJ	12		10		21		37		4.7	UJ	4.8	UJ	4.7	UJ	15		7.4	
Dibenz(a,h)anthracene	140	–	–	3.7	J	14	J	4.8	UJ	4.9	UJ	5.1	J	9.8	J	5.0	UJ	7.3	J	3.8	J	14	J	24	J	4.7	UJ	4.8	UJ	4.7	UJ	5.6	J	4.2	J
Benzo(g,h,i)perylene	–	–	–	11		26		3.4	J	3.4	J	10		22		3.5	J	13		14		24		35		4.7	UJ	4.3	J	4.7	UJ	15		9.3	
HPAH	–	–	1,200	456		428		101		80		426		480		191		354		280		1,652		5,490		88		80		142		953		563	
Total PAH	1,400	–	–	27		54		8		7		38		42		9		30		23		91		171		6		7		8		56		32	
Miscellaneous Extractables																																	
Dibenzofuran	15,000	–	–	16		5.7		3.8	J	2.4	J	10		14		3.0	J	11		12		46		47		4.7	UJ	5.3		24		5.6		44	
Phenols																																	
Pentachlorophenol	8,300	–	–	23	U	24	U	24	U	24	U	23	U	25.0	U	25	U	24	U	24	U	24	U	24	U	23	U	24	U	24	U	23	U	23	U

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene.

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds. Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes.

Total PAH expressed as Toxicity Equivalent Factor Method in WAC 173-340-708(g)

Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

= ROD-Established MTCA Method B, Carcinogen Concentration

= ROD Intertidal Sediment Human Health Criterion

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit, concentration estimated

UJ = Analyte not detected, reporting limit estimated

23. East Beach Subsurface Sediment Monitoring Results Compared to the SMS

Parameter	SQS (mg/kg OC)	MCUL (mg/kg OC)	LAET (µg/kg dry weight)	2LAET (µg/kg dry weight)	Station ID / Blind ID																			
					M10-E4 101911007			M10-E4 101911008			N10-A4 101711010		N10-B4 101811007		N10-B4 101811008		N11-A2 101811004			N11-A2 101811005		N11-B2 101811016		
					10 - 85 cm bms			85 - 166 cm bms			10 - 33 cm bms		10 - 52 cm bms		52 - 123 cm		10 - 43 cm bms			91 - 123 cm		10 - 70 cm bms		
Conventionals (%)																								
Total Solids (%)					79.8		---	87.2		---	83.9		91.3		85.9		83		---	91.9		83.3		
Total Organic Carbon (%)					0.7		---	0.7		---	0.4		0.4		0.3		0.5		---	0.3		0.4		
Grain Size (%)																								
Particle/Grain Size, Gravel (> 2 mm)					3.2		---	40.8		---	0.5		0.9		4.9		19.7		---	73.8		0.7		
Particle/Grain Size Sand (0.063 mm - < 2 mm)					86.9		---	51.8		---	88.5		93.5		89.4		70.3		---	20.7		91.3		
Particle/Grain Size, Silt (0.007 mm - < 0.063 mm)					4.7		---	4.6		---	11		2.8		2.9		7		---	4.9		4.6		
Particle/Grain Size, Clay (<0.007 mm)					5.0		---	2.7		---	0.1	U	2.7		2.9		3		---	0.8		3.4		
					Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result mg/kg OC	Result µg/kg	Q	Result µg/kg	Q	
PAHs																								
Naphthalene	99	170	2,100	2,100	3,300		495	1,000,000		135,870	3,700		100		14		170		34	56		200		
2-Methylnaphthalene	38	64	670	670	1,500		225	540,000		73,370	610		22		4.8	U	36		7.2	18		45		
Acenaphthylene	66	66	1,300	1,300	43		6.5	14,000	U	1,902	180		11		4.8	U	67		13	130		4.6		
Acenaphthene	16	57	500	500	1,200		180	200,000		27,174	650		25		2.4	J	710		143	6,300		44		
Fluorene	23	79	540	540	530		80	110,000		14,946	2,700		30		4.8	U	260		52	330		10		
Phenanthrene	100	480	1,500	1,500	1,400		210	240,000		32,609	4,100		98		5	U	2,300		462	20,000		32		
Anthracene	220	1,200	960	960	340		51	39,000		5,299	5,300		76		4.8	U	4,900		984	5,100		29		
LPAH	370	780	5,200	5,200	6,813		1,023	1,603,000		217,799	16,630		340		36		8,407		1,688	31,916		319		
Fluoranthene	160	1,200	1,700	2,500	700		105	91,000		12,364	12,000		340		5	U	9,000		1,807	23,000		28		
Pyrene	1,000	1,400	2,600	3,300	1,500		225	61,000		8,288	30,000		870		5.7		12,000		2,410	17,000		150		
Benzo(a)anthracene	110	270	1,300	1,600	320		48	16,000		2,174	7,100		170		4.8	U	2,700		542	4,700		16		
Chrysene	110	460	1,400	2,800	460		69	16,000		2,174	5,900		170		4.8	U	4,200		843	2,500		19		
Benzo(b)fluoranthene	---	---	---	---	380		57	5,000	J	679	2,300		130		4.8	U	940		189	1,300		29		
Benzo(k)fluoranthene	---	---	---	---	380		57	5,000	J	679	2,300		130		4.8	U	940		189	1,300		29		
Total Benzofluoranthenes	230	450	3,200	3,600	760		114	10,000	J	1,359	4,600		260		4.8	U	1,900		382	2,600		57		
Benzo(a)pyrene	99	210	1,600	1,600	370		56	14,000	U	1,902	1,900		110		4.8	U	880		177	1,200		24		
Indeno(1,2,3-cd)pyrene	34	88	600	690	95		14	14,000	U	1,902	450		27		4.8	U	200		40	220		6.4		
Dibenz(a,h)anthracene	12	33	230	230	60		9.0	14,000	U	1,902	320		16		4.8	U	120		24	150		4.6		
Benzo(g,h,i)perylene	31	78	670	720	110	Q	17	14,000	U	1,902	450		30		4.8	U	180		36	200		8.6		
HPAH	960	5,300	12,000	17,000	4,375		657	250,000		33,967	62,720		1,993		44		31,180		6,261	50,870		314		
Miscellaneous Extractables																								
Dibenzofuran	15	58	540	540	690		104	110,000		14,946	1,200		31		4.8	U	120		24	460		12		
Phenols																								
Pentachlorophenol	360	690	n.v.	n.v.	24	U	--	72,000	U	--	300	U	23	U	24	U	50	U	--	91	U	23	U	

bms = below mud surface

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene Fluorene, Phenanthrene, and Anthracene.

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

≥ 2LAET
≥ MCUL
≥ SQS

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit; concentration estimated

UJ = Analyte not detected; reporting limit estimated

U = reporting limit exceeds standard

23. East Beach Subsurface Sediment Monitoring Results Compared to the SMS

Parameter	SQS (mg/kg OC)	MCUL (mg/kg OC)	LAET (µg/kg dry weight)	2LAET (µg/kg dry weight)	Station ID / Blind ID															
					N11-B2 101811017		N11-B5 101911009		N11-B5 101911010		N11-C5 101711019		N11-C5 101711020		N11-D5 101811019		N11-D5 101811020			
					70 - 104 cm bms		10 - 53 cm bms		53 - 232 cm bms		10 - 78 cm bms		78 - 137 cm bms		21 - 64 cm bms		64 - 100 cm bms			
Conventionals (%)																				
Total Solids (%)					84.6		81.5		85.6		81.7		86		84.3		91.5		---	
Total Organic Carbon (%)					0.2		0.3		0.1		0.395		0.144		0.4		0.7		---	
Grain Size (%)																				
Particle/Grain Size, Gravel (> 2 mm)					1.1		0.9		5.3		1.4		44.7		2.6		70.1		---	
Particle/Grain Size Sand (0.063 mm - < 2 mm)					92.7		90.5		84.7		94		46.8		92.2		24.8		---	
Particle/Grain Size, Silt (0.007 mm - < 0.063 mm)					3.9		4.1		5.8		4.6		7.5		2.4		4.2		---	
Particle/Grain Size, Clay (<0.007 mm)					2.4		4.5		4.2		0.1	U	0.8		2.8		1.1		---	
					Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result µg/kg	Q	Result mg/kg OC	
PAHs																				
Naphthalene	99	170	2,100	2,100	66		960		610		46		65		34		26		4.0	
2-Methylnaphthalene	38	64	670	670	15		1,800		34		4.1	U	5.3		15		6.0		0.9	
Acenaphthylene	66	66	1,300	1,300	4.9	U	83		4.8	U	4.6		4.8	U	6.3		9.3		1.4	
Acenaphthene	16	57	500	500	21		3,000		72		8.7	J	9.1	J	15		18		2.8	
Fluorene	23	79	540	540	4.9	U	2,200		63		4.6	UJ	4.8	UJ	12		19		2.9	
Phenanthrene	100	480	1,500	1,500	4.9	U	4,700		53		6.9		4.8	U	47		130		20	
Anthracene	220	1,200	960	960	4.9	U	1,300		4.4	J	12		4.8	U	41		180		28	
LPAH	370	780	5,200	5,200	107		12,243		807		83		93		155		382		58	
Fluoranthene	160	1,200	1,700	2,500	4.9	U	2,500		4.8	U	13		4.8	U	240		880		135	
Pyrene	1,000	1,400	2,600	3,300	4.9	U	1,800		3.4	J	40		4.8	U	860		2,100		321	
Benzo(a)anthracene	110	270	1,300	1,600	4.9	U	460		4.8	U	12		4.8	U	81		300		46	
Chrysene	110	460	1,400	2,800	4.9	U	390		4.8	U	11		4.8	U	79		280		43	
Benzo(b)fluoranthene	---	---	---	---	4.9	U	180		4.8	U	13		4.8	U	66		140		21	
Benzo(k)fluoranthene	---	---	---	---	4.9	U	180		4.8	U	13		4.8	U	66		140		21	
Total Benzofluoranthenes	230	450	3,200	3,600	4.9	U	360		4.8	U	26		4.8	U	130		290		44	
Benzo(a)pyrene	99	210	1,600	1,600	4.9	U	160		4.8	U	13		4.8	U	47		130		20	
Indeno(1,2,3-cd)pyrene	34	88	600	690	4.9	U	42		4.8	U	4.6		4.8	U	12		28		4.3	
Dibenz(a,h)anthracene	12	33	230	230	4.9	U	23		4.8	U	2.3	J	4.8	U	6.8		21		3.2	
Benzo(g,h,i)perylene	31	78	670	720	4.9	U	50	J	4.8	U	5.5		4.8	U	14		33		5.0	
HPAH	960	5,300	12,000	17,000	44		5,785		42		127		43		1,470		4,062		621	
Miscellaneous Extractables																				
Dibenzofuran	15	58	540	540	4.9	U	1,800		80		3.2	J	4.8	U	12		8.3		1.3	
Phenols																				
Pentachlorophenol	360	690	n.v.	n.v.	24	U	57	U	24	U	23	U	24	U	24	U	23	U	3.5	

bms = below mud surface

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene.

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene

≥ 2LAET
≥ MCUL
≥ SQS

U = Analyte not detected at the reporting limit

J = Analyte detected above the reporting limit; concentration estimated

UJ = Analyte not detected; reporting limit estimated

U = reporting limit exceeds standard

23. Clam Tissue Total PAHs from all Locations

Sample Location:	East Beach # 1			East Beach # 2			East Beach #3			Intertidal #2			Intertidal Beach #3			Intertidal Cup # 1			Intertidal Cup # 3			North Shoal # 1			North Shoal # 2			North Shoal # 3			North Shoal Rep		
Percent Lipids	%			%			%			%			%			%			%			%			%			%			%		
	0.54			0.49			0.40			0.55			0.59			0.47			0.71			0.56			0.53			0.48			0.60		
PAHs	Result µg/kg-w	Q	Lipid normalized mg/kg	Result µg/kg-w	Q	Lipid normalized mg/kg	Result µg/kg-w	Q	Lipid normalized mg/kg	Result µg/kg-w	Q	Lipid normalized mg/kg	Result µg/kg-w	Q	Lipid normalized mg/kg	Result µg/kg-w	Q	Lipid normalized mg/kg	Result µg/kg-w	Q	Lipid normalized mg/kg	Result µg/kg-w	Q	Lipid normalized mg/kg	Result µg/kg-w	Q	Lipid normalized mg/kg	Result µg/kg-w	Q	Lipid normalized mg/kg	Result µg/kg-w	Q	Lipid normalized mg/kg
2-Methylnaphthalene	1.4	U	0.26	1.3	U	0.27	1.6	U	0.4	1.3	U	0.24	1.2	U	0.2	1.5	U	0.32	1.7	U	0.24	1	U	0.18	1	U	0.19	1.6	U	0.33	3.5		0.76
Acenaphthene	0.93	U	0.17	1.6		0.33	1		0.25	0.93	U	0.17	0.92	U	0.16	0.99		0.21	0.99		0.14	1.2		0.21	1.4		0.26	1.5		0.31	1.2		0.26
Acenaphthylene	0.93	U	0.17	0.93	U	0.19	0.95	U	0.24	1.1		0.2	1		0.17	1.2		0.26	1.6		0.23	1.4		0.25	1.2		0.23	1.3		0.27	0.95	U	0.21
Anthracene	4.5		0.83	4.3		0.88	5.2		1.3	10		1.82	10		1.69	9.6		2.04	17		2.39	10		1.79	9.9		1.87	11		2.29	5.3		1.15
Benz[a]anthracene	2.1		0.39	3		0.61	2.9		0.73	2.2		0.4	1.8		0.31	2.4		0.51	3.4		0.48	2.8		0.5	3.5		0.66	2.6		0.54	2		0.43
Benzo[a]pyrene	1.2		0.22	1.6		0.33	1.2		0.3	1.1		0.2	1.2		0.2	1.3		0.28	1.5		0.21	3.4		0.61	3		0.57	2.3		0.48	1.4		0.3
Benzo[b]fluoranthene	0.93	U	0.17	1.7		0.35	1.9		0.48	1.8		0.33	1.7		0.29	2.2		0.47	2.6		0.37	4.2		0.75	3.3		0.62	2.9		0.6	2		0.43
Benzo[g,h,i]perylene	5.7		1.06	5.1		1.04	6		1.5	6.8		1.24	6.3		1.07	5.1		1.09	6.2		0.87	5.8		1.04	5.2		0.98	4.3		0.9	4.3		0.93
Benzo[k]fluoranthene	0.93	U	0.17	0.93	U	0.19	0.95	U	0.24	0.93	U	0.17	0.92	U	0.16	0.92	U	0.2	0.95	U	0.13	1.2		0.21	1.1		0.21	1.4		0.29	0.95	U	0.21
Chrysene	1.9	U	0.35	1.9	U	0.39	1.9	U	0.48	1.9	U	0.35	1.9	U	0.32	1.8	U	0.38	1.9	U	0.27	1.9	U	0.34	1.8	U	0.34	1.9	U	0.4	1.9	U	0.41
Dibenz[a,h]anthracene	0.93	U	0.17	0.93	U	0.19	0.95	U	0.24	0.93	U	0.17	0.92	U	0.16	0.92	U	0.2	0.95	U	0.13	0.95	U	0.17	0.91	U	0.17	0.94	U	0.2	0.95	U	0.21
Dibenzofuran	0.93	U	0.17	1.1		0.22	0.95	U	0.24	0.93	U	0.17	0.92	U	0.16	0.84	J	0.18	0.95	U	0.13	1.1		0.2	1		0.19	1.2		0.25	0.98		0.21
Fluoranthene	3.9		0.72	7.6		1.55	5.2		1.3	7.3		1.33	6.4		1.08	7.3		1.55	7.3		1.03	11		1.96	15		2.83	9		1.88	7.5		1.63
Fluorene	0.93	U	0.17	1.6		0.33	1.1		0.28	1.2		0.22	1		0.17	1.2		0.26	1.4		0.2	1.7		0.3	1.5		0.28	1.9		0.4	1.6		0.35
Indeno[1,2,3-c,d]pyrene	1.9	U	0.35	1.9	U	0.39	1.9	U	0.48	1.9	U	0.35	1.9	U	0.32	1.8	U	0.38	1.9	U	0.27	1.9	U	0.34	1.8	U	0.34	1.9	U	0.4	1.9	U	0.41
Naphthalene	1.1	U	0.2	1.4	U	0.29	1.5	U	0.38	0.93	U	0.17	1	U	0.17	1.1	U	0.23	1.3	U	0.18	1.8	U	0.32	2.1	U	0.4	2	U	0.42	1.4	U	0.3
Phenanthrene	3.3		0.61	6.7		1.37	4.7		1.18	5.2		0.95	4.5		0.76	4.8		1.02	4.5		0.63	6.4		1.14	6.7		1.26	7		1.46	6		1.3
Pyrene	4.8		0.89	11		2.24	26		6.5	7.1		1.29	8.3		1.41	11		2.34	9.7		1.37	24		4.29	26		4.91	14		2.92	13		2.83
Sums																																		
nd = RL	38.31		7.09	54.59		11.14	65.9		16.48	53.55		9.74	51.88		8.79	55.97		11.91	65.84		9.27	81.75		14.6	86.41		16.3	68.74		14.32	56.83		12.35
nd = 0*RL	25.5		4.72	41		9.24	55.2		13.8	43.8		7.96	42.2		7.15	47.93		10.02	56.19		7.91	74.2		13.25	78.8		14.87	60.4		12.58	47.18		10.6
nd = 0.5*RL	31.91		5.91	45.65		10.37	60.55		15.26	48.68		8.85	47.04		7.97	51.95		10.87	61.02		8.59	77.98		13.92	82.61		15.59	64.57		13.45	51.21		12.49

nd = RL: Total PAHs calculated using the reporting limit for all non-detected values
nd = 0*RL: Total PAHs calculated using zero for all non-detected values
nd = 0.5*RL: Total PAHs calculated using one half of the reporting limit for all non-detected values
U = Analyte was not detected at the reporting limit
J = Analyte detected above the reporting limit, concentration estimated

24. Clam Tissue Carcinogenic PAH (cPAH) Concentrations from all Locations

Sample Location	East Beach # 1				East Beach # 2				East Beach #3			
Percent Lipids	%				%				%			
	0.54				0.49				0.40			
PAHs	Result µg/kg-w	Q	Lipid normalized mg/kg	TEQ	Result µg/kg-w	Q	Lipid normalized mg/kg	TEQ	Result µg/kg-w	Q	Lipid normalized mg/kg	TEQ
Benz(a)anthracene	2.1		0.39	0.21	3		0.61	0.3	2.9		0.73	0.29
Benz(a)pyrene	1.2		0.22	1.2	1.6		0.33	1.6	1.2		0.3	1.2
Benzo(b)fluoranthene	0.93	U	0.17	0.0465	1.7		0.35	0.17	1.9		0.48	0.19
Benzo(k)fluoranthene	0.93	U	0.17	0.00465	0.93	U	0.19	0.00465	0.95	U	0.24	0.00475
Benzo[g,h,i]perylene	5.7		1.06	0.0057	5.1		1.04	0.0051	6		1.5	0.006
Chrysene	1.9	U	0.35	0.95	1.9	U	0.39	0.95	1.9	U	0.48	0.95
Dibenz(a,h)anthracene	0.93	U	0.17	0.465	0.93	U	0.19	0.465	0.95	U	0.24	0.475
Indeno[1,2,3-cd]pyrene	1.9	U	0.35	0.095	1.9	U	0.39	0.095	1.9	U	0.48	0.095
Total cPAH, 0.5*RL				2.98				3.59				3.21
Total cPAH, KM Sum				1.528				2.28				1.896
Total cPAH, lipid mg/kg			2.89				3.48				4.43	

Sample Location	Intertidal #2				Intertidal Beach #3				Intertidal Cap # 1				Intertidal Cap # 3			
Percent Lipids	%				%				%				%			
	0.55				0.59				0.47				0.71			
PAHs	Result µg/kg-w	Q	Lipid normalized mg/kg	TEQ	Result µg/kg-w	Q	Lipid normalized mg/kg	TEQ	Result µg/kg-w	Q	Lipid normalized mg/kg	TEQ	Result µg/kg-w	Q	Lipid normalized mg/kg	TEQ
Benz(a)anthracene	2.2		0.4	0.22	1.8		0.31	0.18	2.4		0.51	0.24	3.4		0.48	0.34
Benz(a)pyrene	1.1		0.2	1.1	1.2		0.2	1.2	1.3		0.28	1.3	1.5		0.21	1.5
Benzo(b)fluoranthene	1.8		0.33	0.18	1.7		0.29	0.17	2.2		0.47	0.22	2.6		0.37	0.26
Benzo(k)fluoranthene	0.93	U	0.17	0.00465	0.92	U	0.16	0.0046	0.92	U	0.2	0.0046	0.95	U	0.13	0.00475
Benzo[g,h,i]perylene	6.8		1.24	0.0068	6.3		1.07	0.0063	5.1		1.09	0.0051	6.2		0.87	0.0062
Chrysene	1.9	U	0.35	0.95	1.9	U	0.32	0.95	1.8	U	0.38	0.9	1.9	U	0.27	0.95
Dibenz(a,h)anthracene	0.93	U	0.17	0.465	0.92	U	0.16	0.46	0.92	U	0.2	0.46	0.95	U	0.13	0.475
Indeno[1,2,3-cd]pyrene	1.9	U	0.35	0.095	1.9	U	0.32	0.095	1.8	U	0.38	0.09	1.9	U	0.27	0.095
Total cPAH, 0.5*RL				3.02				3.07				3.22				3.63
Total cPAH, KM Sum				1.688				1.72				1.968				2.368
Total cPAH, lipid mg/kg			3.19				2.82				3.5				2.73	

Sample Location	North Shoal # 1				North Shoal # 2				North Shoal # 3				North Shoal Rep			
Percent Lipids	%				%				%				%			
	0.56				0.53				0.48				0.60			
PAHs	Result µg/kg-w	Q	Lipid normalized mg/kg	TEQ	Result µg/kg-w	Q	Lipid normalized mg/kg	TEQ	Result µg/kg-w	Q	Lipid normalized mg/kg	TEQ	Result µg/kg-w	Q	Lipid normalized mg/kg	TEQ
Benz(a)anthracene	2.8		0.5	0.28	3.5		0.66	0.35	2.6		0.54	0.26	2		0.43	0.2
Benz(a)pyrene	3.4		0.61	3.4	3		0.57	3	2.3		0.46	2.3	1.4		0.3	1.4
Benzo(b)fluoranthene	4.2		0.75	0.42	3.3		0.62	0.33	2.9		0.6	0.29	2		0.43	0.2
Benzo(k)fluoranthene	1.2		0.21	0.012	1.1		0.21	0.011	1.4		0.29	0.014	0.95	U	0.21	0.00475
Benzo[g,h,i]perylene	5.8		1.04	0.0058	5.2		0.98	0.0052	4.3		0.9	0.0043	4.3		0.93	0.0043
Chrysene	1.9	U	0.34	0.95	1.8	U	0.34	0.9	1.9	U	0.4	0.95	1.9	U	0.41	0.95
Dibenz(a,h)anthracene	0.95	U	0.17	0.475	0.91	U	0.17	0.455	0.94	U	0.2	0.47	0.95	U	0.21	0.475
Indeno[1,2,3-cd]pyrene	1.9	U	0.34	0.095	1.8	U	0.34	0.09	1.9	U	0.4	0.095	1.9	U	0.41	0.095
Total cPAH, 0.5*RL				5.64				5.14				4.38				3.33
Total cPAH, KM Sum				4.416				3.984				3.112				1.976
Total cPAH, lipid mg/kg			3.96				3.89				3.8				3.35	

nd = RL: cPAHs calculated using the reporting limit for all non-detected values
nd = 0*RL: cPAHs calculated using zero for all non-detected values
nd = 0.5*RL: cPAHs calculated using one half of the reporting limit for all non-detected values
KM Sum = Kaplan-Meier Analysis
U = Analyte was not detected at the reporting limit
TEQ = Toxicity Equivalency Quotient
TEF = Toxicity Equivalency Factor

PAHs	TEF
Benz(a)anthracene	0.1
Benz(a)pyrene	1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.01
Benzo[g,h,i]perlene	0.001
Chrysene	1
Dibenz(a,h)anthracene	1
Indeno[1,2,3-cd]pyrene	0.1

25. Bird Survey Results

Station	English Name	Latin Name	September 2011				May 2012			
			Observed On Station	Flying	Total	Notes	Observed On Station	Flying	Total	Notes
1	Double-crested cormorant	*Phalacrocorax auritus*	1	1	2	In water	0	0	0	
	Great blue heron	*Ardea herodias*	3	0	3	1 juvenile	0	0	0	
	Rock dove	*Columba livia*	2	2	2	Upper beach only	0	0	0	
	Bufflehead	*Bucephala albeola*	0	0	0		3	0	3	In water
	Pigeon guillemot	*Cepphus columba*	0	0	0		1	1	1	
	American robin	*Turdus migratorius*	0	0	0		1	0	1	Singing in riparian
	Song sparrow	*Melospiza melodia*	0	0	0		2	0	2	Singing in riparian
	Bewick's wren	*Thryomanes bewickii*	0	0	0		1	0	1	Singing in riparian
	Bald eagle	*Haliaeetus leucocephalus*	0	0	0		1	1	1	Adult
	Glaucous-winged gull	*Larus glaucescens*	0	0	0		2	2	2	
	White-crowned sparrow	*Zonotrichia atricapilla*	0	0	0		2	0	2	In riparian
2	Sharp-shinned hawk	*Accipiter striatus*	1	0	1	On fence	0	0	0	
	American crow	*Corvus brachyrhynchos*	0	0	0		2	6	6	On beach
	Canada goose	*Branta canadensis*	0	0	0		2	2	2	Flew to treatment area
	American goldfinch	*Carduelis tristis*	0	0	0		4	4	4	
	Mallard	*Anas platyrhynchos*	0	0	0		2	2	2	
	Glaucous-winged gull	*Larus glaucescens*	0	0	0		1	1	1	
	Killdeer	*Charidrius dubius*	0	0	0		1	1	1	
	Barn swallow	*Hirundo rustica*	0	0	0		2	2	2	
	Dark-eyed junco	*Junco hyemalis*	0	0	0		2	0	2	In riparian
3	Red-necked grebe	*Podiceps grisegena*	1	0	1	In water	0	0	0	
	Great blue heron	*Ardea herodias*	1	0	1	Caught fish	0	0	0	
	Glaucous-winged gull	*Larus glaucescens*	5	5	10		3	0	3	In intertidal
	Belted kingfisher	*Ceryle alcyon*	0	1	1					
	Barn swallow	*Hirundo rustica*	0	19	19		2	7	9	On fence
	House finch	*Capodacus mexicanus*	2	0	2	On fence	2	0	2	On fence
	American crow	*Corvus brachyrhynchos*	0	0	0		3	0	3	In intertidal
	Bufflehead	*Bucephala albeola*	0	0	0		3	0	3	In water
	Violet-green swallow	*Tachycineta thalassina*	0	0	0		2	2	2	On fence
	American robin	*Turdus migratorius*	0	0	0		1	0	1	On beach
4	Double-crested cormorant	*Phalacrocorax auritus*	0	2	2		0	0	0	
	Great blue heron	*Ardea herodias*	1	0	0		0	0	0	
	Western sandpiper	*Calidris mauri*	2	0	0	At water's edge	0	0	0	
	Glaucous-winged gull	*Larus glaucescens*	6	0	6	At water's edge	1	1	1	On beach
	American crow	*Corvus brachyrhynchos*	1	2	3		0	0	0	
	Common loon	*Gavia immer*	0	0	0		1	0	1	In water
	Surf scoter	*Melanitta perspicillata*	0	0	0		2	0	2	In channel
	White-winged scoter	*Melanitta fusca*	0	0	0		2	2	2	Flew and in channel
	Bufflehead	*Bucephala albeola*	0	0	0		5	5	5	In channel
	Barn swallow	*Hirundo rustica*	0	0	0		1	1	1	
	Killdeer	*Charidrius dubius*	0	0	0		1	1	1	Flew to treatment area
5	Double-crested cormorant	*Phalacrocorax auritus*	0	1	1		0	0	0	
	Great blue heron	*Ardea herodias*	1	0	1	feeding	0	0	0	
	Glaucous-winged gull	*Larus glaucescens*	7	0	7		3	0	3	In channel
	Bufflehead	*Bucephala albeola*	0	0	0		18	0	18	In channel
	Killdeer	*Charidrius dubius*	0	0	0		2	2	2	Flew to treatment area
	Bald eagle	*Haliaeetus leucocephalus*	0	0	0		1	1	1	Immature
	Barrow's goldeneye	*Bucephala islandica*	0	0	0		3	3	3	
	Barn swallow	*Hirundo rustica*	0	2	2		3	3	3	
6	Double-crested cormorant	*Phalacrocorax auritus*	1	0	1	In water	0	0	0	
	Great blue heron	*Ardea herodias*	1	0	1	In water	1	1	2	In intertidal
	Surf scoter	*Melanitta perspicillata*	0	1	1		0	0	0	
	Glaucous-winged gull	*Larus glaucescens*	5	0	5	1 in water	4	0	4	1 in water
	Bufflehead	*Bucephala albeola*	0	0	0		10	0	10	In channel
	Song sparrow	*Melospiza melodia*	0	0	0		2	0	2	In riparian
	American goldfinch	*Carduelis tristis*	0	0	0		3	3	3	
	Belted kingfisher	*Ceryle alcyon*	0	1	1	Flushed from beach	0	0	0	
Total	Red-necked grebe	*Podiceps grisegena*	1	0	1		0	0	0	
	Double-crested cormorant	*Phalacrocorax auritus*	2	4	6		0	0	0	
	Great blue heron	*Ardea herodias*	7	0	7		1	1	2	
	Surf scoter	*Melanitta perspicillata*	0	0	1		2	0	2	
	Sharp-shinned hawk	*Accipiter striatus*	1	0	1		0	0	0	
	Western sandpiper	*Calidris mauri*	2	0	2		0	0	0	
	Glaucous-winged gull	*Larus glaucescens*	23	5	28		14	4	14	
	Rock dove	*Columba livia*	2	0	2		0	0	0	
	Belted kingfisher	*Ceryle alcyon*	0	2	2		0	0	0	
	Barn swallow	*Hirundo rustica*	0	21	21		8	13	15	
	American crow	*Corvus brachyrhynchos*	1	2	3		5	6	9	
	House finch	*Capodacus mexicanus*	2	0	2		2	0	2	
	Bufflehead	*Podiceps grisegena*	0	0	0		39	5	39	
	Pigeon guillemot	*Cepphus columba*	0	0	0		1	1	1	
	American robin	*Turdus migratorius*	0	0	0		2	0	2	
	Song sparrow	*Melospiza melodia*	0	0	0		4	0	4	
	Bewick's wren	*Thryomanes bewickii*	0	0	0		1	0	1	
	Bald eagle	*Haliaeetus leucocephalus*	0	0	0		2	2	2	
	White-crowned sparrow	*Zonotrichia atricapilla*	0	0	0		2	0	2	
	Canada goose	*Branta canadensis*	0	0	0		2	2	2	
	American goldfinch	*Carduelis tristis*	0	0	0		7	7	7	
	Mallard	*Anas platyrhynchos*	0	0	0		2	2	2	
	Killdeer	*Charidrius dubius*	0	0	0		4	4	4	
	Dark-eyed junco	*Junco hyemalis*	0	0	0		2	0	2	
	Violet-green swallow	*Tachycineta thalassina*	0	0	0		2	2	2	
	Common loon	*Gavia immer*	0	0	0		1	0	1	
	White-winged scoter	*Melanitta fusca*	0	0	0		2	2	2	
	Barrow's goldeneye	*Bucephala islandica*	0	0	0		3	3	3	

26. Invertebrate and Macroalgae Sample Results

Substrate/Species	Group	East Beach T1		North Shoal T2		Intertidal Cap T3			EBS T4		
		L	M	L	M	L	M	H	L	M	H
Sediment Characterization											
Sand percent	substrate	90	33	90	90	50	50	100	50	95	100
Gravel percent	substrate	10	33	10	10	50	50	0	50	5	0
Cobble percent	substrate	0	33	0	0	0	0	0	0	0	0
Macroalgae											
Zostera spp. (not attached)	plant		X	X							
Fucus sp. (not attached)	brown alga		X		X						
Laminaria saccharina (not attached)	brown alga		X	X							
Ulva spp. (not attached)	green alga	X				X	X				
Enteromorpha spp. (not attached)	green alga	X				X	X				
Mastocarpus papillatus (not attached)	red alga		X		X						
Ceramium spp.	red alga	X	X	X	X						
Porphyra sp.	red alga		X								
Sarcodiotheca spp.	red alga			X	X						
Callophyllis spp.	red alga		X	X	X						
Invertebrates											
Amphipoda	amphipod	X					X	X			X
Anthopleura spp.	anemone	X									
Barnacles	barnacle					X					
Lottid Limpet	limpet	X				X	X				
Macoma spp.	bivalve					X					
Tellina spp.	bivalve			X			X				
Lacuna spp.	gastropod			X							
Unidentified Gastropod 1	gastropod				X						
Spiochaetopterus tube	polychaete	X		X							
Unidentified Polychaete 1	polychaete					X					
Unidentified Polychaete 2	polychaete					X					
Unidentified Polychaete 3	polychaete					X					
Family Hippolytidae	shrimp	X									

L= Station located at approximately +0.6 ft MLLW

M = Station located at approximately MSL (+6.7 ft MLLW)

H = Station located at approximately MHHW (+11.3 ft MLLW)

27. November 29, 2011 and February 8, 2012 Egg Tally and Densities from the EBS and Intertidal Cap

Sample Number (transect)	GPS Coordinates (Start of Transect) (End of Transect)		Substrate	Number of Eggs		Species[1]		Weight of Examined Sample (g)		Density of Forage Fish Spawn[2] (eggs/g)	
	Latitude (N)	Longitude (W)		11/29/2011	2/8/2012	11/29/2011	2/8/2012	11/29/2011	2/8/2012	11/29/2011	2/8/2012
1A	47.61691	122.50291	fine sand	0	0	NA	NA	NA	NA	NA	NA
	47.6167	122.50317									
1B	47.61693	122.50295	fine sand	0	0	NA	NA	NA	NA	NA	NA
	47.61674	122.50321									
2A	47.61627	122.5037	sand	1	1	Surf smelt	Surf smelt	119.2	129.1	0.008	0.008
	47.61614	122.50407									
2B	47.6163	122.50375	sand	0	0	NA	NA	NA	NA	NA	NA
	47.61618	122.50408									
3A	47.61606	122.50474	sand	2	1	Sand lance	Sand lance	135.9	148.3	0.015	0.007
	47.61609	122.50515									
3B	47.6161	122.50474	sand	4	0	Sand lance	NA	125	NA	0.032	NA
	47.61613	122.50513									
4A	47.61613	122.50566	sand	14	2	Sand lance	Sand lance	125.4	130.2	0.112	0.015
	47.61621	122.50606									
4B	47.61618	122.50564	sand to pea gravel	0	1 egg 3 larvae	NA	Sand lance	NA	122.3	NA	0.033[3]
	47.61625	122.50604									
5A	47.61642	122.50682	pea gravel underlain by sand	6	3	Sand lance	1 Sand lance 2 Surf smelt	125.6	139.4	0.048	0.022
	47.61648	122.50723									
5B	47.61648	122.50681	pea gravel underlain by sand	0	9	NA	NA	NA	NA	NA	NA
	47.61653	122.50721									
Total eggs								**November 29, 2011; 26 Sand lance and 1 Surf smelt**			
								February 8, 2012; 5 Sand lance eggs, 3 Sand lance larvae, and 3 Surf smelt			

[1] Egg species identification was confirmed by Mr. Dan Penttila (Penttila 2011)

[2] Density estimates are for total forage fish spawn, not by species

[3] Density estimates for sample 4B include larvae and egg in calcualtion

28 Risk Calculation

Wyckoff Data

Chronic daily intake (CDI) (mg/kg-day) for clams only = EPC-cl × IR-cl × FI × EF × ED-a × CF × 1/BW-a × 1/AT

Parameters are explained on second worksheet

B(a)P Summation Methods include 0.5*RL and Kaplan-Meier (K-M)

Adult	CDI	EPC-cl	IR-cl(adult)	FI	EF	ED-a	CF	1/BW	1/AT
Half-RL	2.677E-05	0.004244	498.4	1	365	70	0.001	0.012658	3.91389E-05
K-M	1.912E-05	0.00303	498.4	1	365	70	0.001	0.012658	3.91389E-05

Child (see note 1)		EPC-cl	IR-cl(child)	FI	EF	ED-c	CF	1/BW	1/AT
Half-RL	4.198E-06	0.004244	193.9	1	365	6	0.001	0.059524	3.91389E-05
K-M	2.997E-06	0.00303	193.9	1	365	6	0.001	0.059524	3.91389E-05

Benzo(a)pyrene CSFo	7.3 ((mg/kg)/day)-1	IRIS, April 2012 Accession. This is used for adult risk calculation.
Adjusted Benzo(a)pyrene CSFo	73 ((mg/kg)/day)-1	This includes a 10x Age Dependent Adjustment Factor to account for mutagenicity & carcinogenicity

Site Risk = CDI * CSFo

Risk	Adult	Child
Half-RL Summatio	**2.0E-04**	**3.1E-04**
K-M Summation	**1.4E-04**	**2.2E-04**

(1) Child's ingestion scenario at 193.9 g/d; see following risk scenario worksheet for explanation

28 Risk Calculation

Risk Scenario Worksheet

Parameter Code	Parameter Definition	Units	Adult Value	Notes	Parameter Code	Child Value	Notes
$EPC_{cl\ (adult)}$	exposure point concentration in clams	mg/kg ww	0.004244		$EPC_{cl\ (child)}$	0.00303	
IR_{cl} (adult)	ingestion rate – clams	g/kg/day	498.4	1/	IR_{cl} (child)	193.9	5/ 6/
FI	fractional intake derived from source	unitless	1	2/	FI	1	
EF	exposure frequency	days/yr	365	3/	EF	365	
ED_a (adult)	exposure duration	years	70		ED_c (child)	6	
CF	conversion factor	kg/g	0.001		CF	0.001	
BW_a (adult)	Body weight – adult	kg	79	4/	BW_c (child)	16.8	7/
AT_C	averaging time – cancer	days	25,550		AT_C	25,550	

1/ Includes Manila/littleneck clams, horse clams, butter clams, cockles, oysters, and scallops (EPA 2007), and is Puget Sound only

Note: This number is derived from the Puget Sound only adjusted total Suquamish seafood ingestion rate of 766.8 g/day that is used in EPA's Framework. It represents 65% of the total ingestion rate. Although the Framework provides methods for estimating children's consumption at 38.9% of the adult rate (which yields the 193.9 g/day rate in the spreadsheet), please note that the Suquamish survey provides consumption data for children (approximately 392 g/day for the 90% for all consumers) and states that children's consumption is approximately 50% of the Suquamish adult rate.

2/ A fractional intake derived from source of 1 was directed by EPA in the tribal framework guidance document (2007).

3/ Default exposure frequency of 350 days/yr modified to 365 days/yr to account for the fact that tribal seafood consumption rate estimates are based on 365 days/yr.

4/ Average body weight based on information provided by the Suquamish Tribe to EPA for the LDW site.

5/ This was run based upon alternative #3 (page 12) of EPA 2007, at 38.9% of adult consumption; based upon conversations with Lon Kissinger.

6/ This is based upon the 95%ile of "all shellfish" from Table C-6 of the revised Suquamish Report, 4.994 g/kg/d, times 16.8 kg (BWc(child)), and adjusted for 65% of diet from Puget Sound

7/ Based on Suquamish Tribal child body weight

ww - wet weight

Appendix F Public Notice

EPA
United States
Environmental Protection
Agency

Wyckoff Eagle Harbor Superfund Site Cleanup 5-Year Review

The U.S. Environmental Protection Agency (EPA) has begun a Five-Year Review at the Wyckoff Eagle Harbor Superfund site at Bainbridge Island, Washington. The review will evaluate cleanup work at the site. Once final, the review report will be posted to the EPA website and will be available in the EPA Records Center and the Bainbridge Island Public Library.

The Wyckoff / Eagle Harbor site was polluted with creosote, metals, and other hazardous substances from a wood treating facility and shipyards.

Comments or concerns to consider during the review can be addressed to Howard Orlean, EPA Project Manager, **before February 29, 2012,** at 206-553-2851 or toll-free at 1-800-424-4372; by email at orlean.howard@epa.gov; or by mail at 1200 Sixth Ave, Suite 900, Mail Code ECL-111, Seattle WA 98101. *TTY users may call the Federal Relay Service at 800-877-8339 and give the operator Howard's phone number.*

The Administrative Record containing related technical and legal documents is available at:

Bainbridge Island Public Library
1270 Madison Avenue North
Bainbridge Island, WA 98110
206-842-4162

EPA Records Center
1200 Sixth Avenue
Seattle, WA 98101
206-553-4494

For more information or to report concerns about the cleanup, contact Kay Morrison, EPA Community Involvement Coordinator, at 206-553-8321, or visit http://yosemite.epa.gov/r10/cleanup.nsf/sites/wyckoff.

Appendix G Comments Received from Support Agencies and/or the Community

Janet Knox and D. Thomas Fehsenfeld
8150 NE Port Madison Road
Bainbridge Island, WA 98110

March 13, 2012

Sent via Email

Howard Orlean
EPA Project manager
US EPA
1200 Sixth Avenue, Suite 900
Mail Code ECL-111
Seattle, WA 98101

Dear Howard:

The purpose of this letter is to affirm support for the work performed by the Washington Department of Ecology, national experts, and citizen and tribe representatives as documented in *Wyckoff Generational Remedy Evaluation Report* (August 2010), https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=2683

As citizens, members of community organizations, and technical reviewers, we have been involved with the Wyckoff/Eagle Harbor Superfund site since 1987. In the last few years, Janet Knox, Environmental Geochemist, served on the Generational Remedy Steering Committee. In her professional work as a geochemist, she has performed numerous tidal studies of sheet pile walls and assessed contaminant transport through and around such walls. She has studied many sites with nonaqueous phase liquid (NAPL) and has assessed the fate and transport of contaminants from those sites.

The work performed under the Wyckoff Generational Remedy provides EPA with an opportunity—to address more effectively an extremely contaminated site and forestall future disaster of release to Puget Sound. Since EPA performed its pilot study of thermal treatment at the Wyckoff site, the technology of thermal treatment has been improved. As part of the Generational Remedy, the nation's experts in thermal treatment and the cleanup of NAPL sites—including EPA's own experts—reviewed Wyckoff's existing data and concluded that the pilot study was flawed. The Generational Remedy experts performed a feasibility study/reassessment to identify plausible, cost-effective remedies. These remedies can address on-going releases from the Wyckoff site and forestall future, possible releases due to system failure or catastrophic release.

Most importantly, additional data has been collected by EPA since the Record of Decision was written. This data shows that the existing containment system is not, in fact, containing contamination because the aquitard is not continuous across the site and because significant contamination is found outside the sheetpile wall. This work provides an opportunity for EPA to use its own data collected in the last decade to upgrade its site conceptual model and design a remedy that is protective of human health and the environment.

Our previous comments have pertained to analysis of alternatives under Superfund. We have commented that the existing containment does not meet the seven requirements (protection, ARARs, short- and long-term effectiveness, reduction of contaminant mass,

Janet Knox and D. Thomas Fehsenfeld
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cost, implementability), nor the two balancing criteria of state or community acceptance. Based on the most recent review of existing data and costing, the containment remedy is not even implementable and other remedies have become more implementable in the last decade.

As polyaromatic hydrocarbons concentrations continue to increase in Puget Sound sediments, it is prudent to take this opportunity to remove a significant source from release to Puget Sound. (We also note that the contaminants of concern listed on the Five Year Review request for comments do not include dioxins/furans as they should in responsible public disclosure.)

We encourage EPA to seize the day, to seize its own opportunity. EPA can comprehensively use its own existing data and choose a remedy that is protective for human health and the environment.

Sincerely,

Janet Knox and D. Thomas Fehsenfeld

Subject: Comments on 5 Year Review
Cleanup at Wyckoff Eagle harbor
Superfund Site
Date: March 15, 2012

Association of Bainbridge Communities

Association of Bainbridge Communities (ABC)
PO Box 10999
Bainbridge Island
WA 98110

Howard Orlean
EPA Project Manager
US EPA Mail Code ECL-111
1200 Sixth Avenue, Suite 900
Seattle WA 98101
orlean.howard@epa.gov

Dear Howard,

ABC TAG Grant. As you know ABC has recently completed its Technical Assistance Grant (TAG). Half of the time that it covered is included in the five years of the current 5 year review. ABC has advocated strong community involvement of the site over that time frame. This was carried out in part due to this grant, and we hope the final report ABC submitted will at a minimum be referenced in the 5 Year Review, and possibly some the important points in the report covered in the Review.

Cyclone Fence. Although a small point, we would like to thank EPA for removing the razor wire which had been installed on top of the barbed wire cyclone fence. In addition, re-situating the cyclone fence on the SE corner, just south of the site of the former wastewater treatment plant, has allowed for a nice viewpoint and placement of benches, and retained an important cedar tree. That said, the 5 Year Review has to note that the long standing request to move the cyclone fence located between the current storage tanks and the access path to the water is at a standstill. ABC, members of the Citizen Advisory Design Committee and representatives from the Park District and City of Bainbridge Island have met multiple times at the site. Everyone has agreed this would be possible to move the fence towards the tanks to allow vehicle access to the Eagle Harbor waterfront. This would allow access of handicapped, small boat transport and emergency vehicles in case the gates into the EPA facility were not able to be opened in a timely fashion. Please include some mention of these plans to remind all parties to finish this project.

Generational Study. ABC representatives served on the study group which brought in experts on how best to proceed on the cleanup of the Wyckoff site. The proposed remedies would drop the projected date for eventual cleanup from centuries to lifetimes. Hence ABC affirms its support for the work performed by the Washington Department of Ecology, national experts, and citizen and tribe representatives as documented in Wyckoff Generational Remedy Evaluation Report (August 2010). Hence this report and its future consideration needs to be included in the 5- Year review. Finding a viable solution has become even more timely as we watch the steel sheet pile wall rust.

Seeps. During plant visits we have often seen oil-like plumes on the water of the eastern part of the site. I have also seen them while rowing along the wall when the water is flat. EPA has explained these oil slicks in the past as coming from small left over pockets of creosote, expecting them to stop. These discharges of contamination need to be better explained if they persist. Since I have not kept up with this aspect I look forward to reading about the status of these seeps in the 5 year review.

Conclusion. As I am sure it will be included the 5 year review, I will not comment on the new wastewater treatment plant nor the welcome demotion of the old plant which ABC remembers being constructed almost a quarter century ago! However I would like to insert a request that a public meeting covering this 5 Year Review be held on Bainbridge Island as has been the practice in the past. ABC will be pleased to advertise the meeting for Bainbridge Island residents, and of course be ready to ask questions and have comments at the meeting.

Bea regards,

Charles E. Schmid

Charles Schmid
Secretary/Treasurer

FRANK STOWELL
6223 BLAKELY AVENUE
BAINBRIDGE ISLAND, WA 98110

Mr. Howard Orlean
EPA Project Manager
US EPA
1200 Sixth Avenue, Suite 900
Mail Code ECL-111
Seattle, WA 98101

Dear Mr. Orlean, March 14, 2012

I am writing in response to the request from EPA for comments on the Five Year Review of the cleanup at the Wyckoff Eagle Harbor Superfund site on Bainbridge Island where I have lived since 1983. I have become very familiar with the complex issues connected to this Superfund site, and while I was on the Board of the Land Trust, I worked to secure the funding, both public and private, to purchase the land for Pritchard Park. And while I and many other residents on the Island are deeply appreciative of the efforts made by EPA to make considerable progress to clean up the site, I remain gravely concerned about the over one million gallons of creosote and related product that remain underground. The risks that the material may be released from an earthquake, failure of the containment wall, sea level rise or other unexpected events are simply too great to the health of our small Island community or the fragile waters of Puget Sound itself.

Therefore, I would respectfully ask that you commit to working with the Washington Department of Ecology to find a more permanent, long term solution by investigating ways to remove the product from underground. As we have learned from the information and research provided from the Wyckoff Generational Remedy workshop which I attended, there are technical solutions available, such as thermal remediation, which would provide a more permanent solution that is more protective of the environment and the human health of my family and all residents of Bainbridge Island, now and in the future.

Thank you for your consideration.

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Janet Knox and D. Thomas Fehsenfeld

Appendix H Title Search Review Report

REVIEW OF TITLE EXCEPTIONS
WYCKOFF/EAGLE HARBOR SUPERFUND SITE

This is a title review of three tax parcels of land in Bainbridge Island, WA in support of the Wyckoff/Eagle Harbor Superfund Site project

- APN 262502-3-112 (Parcel A: State of Washington, Department of Transportation (WADOT)
- APN 262502-3-113 (Parcel B: Washington Toll Bridge Authority)
- APN 262502-3-149 (Parcel C: State of Washington, Department of Transportation (WADOT)

See parcel map attached.

Review performed June 27, 2012

Title Exception Number	**Current Owner and Affected Assessor Parcel Number (APN)**	**Recording Information**	**Instrument Type and Rights Granted**	**Impact to Institutional Controls contained in Consent Judgment Between the United States and the State filed with US District Court on April 13, 1999 (This document has NOT been recorded)**
1	NA	NA – deleted from amended title report	NA	NA
2	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 363406 recorded July 27, 1942	Easement to construct, reconstruct, operate, inspect, maintain or remove lines of telephone and telegraph or other signal or communication circuits was granted to the Pacific Telephone and Telegraph Co. Easement should be mapped	Disturbance of property could result from installation/maintenance/removal of communication lines.
3	WADOT APN 262502-3-112	Recording No.: 462053 recorded January 29, 1948	Easement to withdraw and transport by pipe line or lines such surplus or excess water in the conduct of their operations as a shipyard granted to the Winslow Marine Railway and Ship Building Co.	None – Shipyard no longer in operation.

Title Exception Number	Current Owner and Affected Assessor Parcel Number (APN)	Recording Information	Instrument Type and Rights Granted	Impact to Institutional Controls contained in Consent Judgment Between the United States and the State filed with US District Court on April 13, 1999 (This document has NOT been recorded)
4	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 774924 recorded July 25, 1962	Easement for electric transmission and/or distribution system granted to Puget Sound Power and Light Co. Easement should be mapped.	Disturbance of property could result from installation/maintenance/removal of electrical lines.
5	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No. 668664, recorded August 23, 1957	Statutory Warranty Deed conveying real property from Winslow Marine Railway and Ship Building Co to Walter C. Woodward, Jr and Frederick O. Tyszko, but reserving an easement 18' wide for an unspecified purpose.	Unknown – purpose of the easement is not disclosed
6	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 673578 recorded Dec. 23, 1957	Perpetual easement for sanitary sewer utility granted to the Town of Winslow. Easement should be mapped.	Disturbance of property could result from installation/maintenance/removal of sanitary sewer lines.
7	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 816780 recorded March 30, 1964	Easement for the purpose of installing, constructing, maintaining, operating, repairing and replacing water pipe line or lines and all necessary connections and appurtenances thereto, with the right of ingress and egress granted to Town of Winslow. Easement should be mapped.	Disturbance of property could result from installation/maintenance/removal of water pipe lines.
8	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 1062928 Recorded Jan. 7, 1974	Easement to construct, improve, repair and maintain an access road and an excavation and embankment granted to AMCO Investments, Inc. Easement should be mapped.	Disturbance of property could result from construction and maintenance of roadway.

Title Exception Number	Current Owner and Affected Assessor Parcel Number (APN)	Recording Information	Instrument Type and Rights Granted	Impact to Institutional Controls contained in Consent Judgment Between the United States and the State filed with US District Court on April 13, 1999 (This document has NOT been recorded)
9	WADOT APN 262502-3-112 WA Toll Bridge Auth APN 262502-3-113	Recording No: 7712020124 recorded Dec. 2, 1977	Non-exclusive right-of-way easement for sanitary sewers with the necessary appurtenances granted to the City of Winslow	See #6
10	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 8004040055 recorded April 4, 1980	Easement for underground electric transmission and/or distribution system granted to Puget Sound Power and Light Co. Easement should be mapped.	See #4
11	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 8107070079 recorded July 7, 1981	Easement for the exclusive right, permit, license and easement to construct and forever maintain a sewer line connection to the existing manhole and to operate all necessary machinery/ equipment thereon granted to the State of WA. Easement should be mapped.	See #6
12	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 8204010104 recorded April 1, 1982	Easement for increase in width of ROW (Instr No 7711160127) for a water main granted to the City of Winslow	Disturbance of property could result from installation/maintenance/removal of water main line.
13	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 8210250001 recorded October 25, 1982	Easement agreement for re-located road easement location for new road easement location granted to the State of WA, Dept. of Transportation.	See #8

Title Exception Number	Current Owner and Affected Assessor Parcel Number (APN)	Recording Information	Instrument Type and Rights Granted	Impact to Institutional Controls contained in Consent Judgment Between the United States and the State filed with US District Court on April 13, 1999 (This document has NOT been recorded)
14	WADOT APN 262502-3-149	Recording No.: 9401070152 recorded: January 7, 1994	Easement agreement for the release of existing road easement location for new road easement location granted to the State of WA, Dept. of Transportation. *(Appears to be a re-recording of #13)*	None
NA	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	NA – Not recorded **Filed with US District Court on April 13, 1999**	Consent Judgment Between the United States and the State (of Washington). Contains Institutional Controls associated with a) Containment Areas, b) Public Access Restrictions, c) Wells, and d) Industrial Use	None
15	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 3172025 recorded April 19, 1999	Notice of Land Use Restriction recorded by Washington State Dept. of Transportation.	None
16	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 1096013 recorded: April 1, 1975	Covenants, conditions, restrictions and/or easements therein for Shoreline Management Substantial Development	None
17	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No.: 7711040146 Recorded Nov 4, 1977	Short Plat Application	None

Title Exception Number	Current Owner and Affected Assessor Parcel Number (APN)	Recording Information	Instrument Type and Rights Granted	Impact to Institutional Controls contained in Consent Judgment Between the United States and the State filed with US District Court on April 13, 1999 (This document has NOT been recorded)
18	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	Recording No. 200408170193 Recorded: August 17,2004	A record of Survey	None
19-21	WADOT APN 262502-3-112 APN 262502-3-149 WA Toll Bridge Auth APN 262502-3-113	NA	General Taxes 2012	NA

Appendix I ARAR Analysis

Changes in Groundwater Cleanup Levels since the ROD for the Soil and Groundwater OU

Contaminant of Concern	Cleanup level in ROD (µg/L)	Changes in cleanup level (µg/L)
Chrysene	2.96E-1[2]	3E+1
Benzo(k)fluoranthene	2.96E-1[2]	3
Benzo(a)pyrene	2.96E-1[2]	3E-2
Dibenzo(a,h)anthracene	7E-3[1]	3E-2
Pentachlorophenol	4.9[2]	1.5 (cancer); 1.2E+3 (noncancer)

1 – Calculated Pore-Water Concentrations based on SMS or HH
2 – MTCA Method B surface water for Human Consumption of Organisms

Changes in Soil Cleanup Levels since the ROD for the Soil and Groundwater OU

Contaminant of concern	Cleanup Levels in ROD (µg/kg)[1]	Changes in Cleanup Levels (µg/kg)
Naphthalene	3.2E+6	1.6E+6
Benzo(a)anthracene	1.37E+2	1.4E+3
Chrysene	1.37E+2	1.4E+5
Benzo(b)fluoranthene	1.37E+2	1.4E+3
Benzo(k)fluoranthene	1.37E+2	1.4E+4
Ideno(1,2,3-cd)pyrene	1.37E+2	1.4E+3
Dioxin(2,3,7,8-TCDD)/TEF	6.67E-3	1.1E-2
Pentachlorophenol	8.33E+3	2.5E+3 (cancer); 4E+5 (noncancer)

1 – MTCA Method B Cleanup levels from 1996.

Soil and Groundwater OU ARAR Analysis

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
All media/ Washington State Model Toxics Control Act (MTCA)	WAC 173-340-360(4)/WAC 173-340-360(5)(d)/ WAC 173-340-360(6)	Applicable	Identifies the order of preference of cleanup technologies, including treatment as the highest preference Identifies the state's preference for permanent solutions to the maximum extent possible. Provides for selecting a cleanup that provides a reasonable restoration time frame and indentifies factors to be considered when establishing that time frame.	No changes to this requirement. This requirement is currently not applicable, relevant or appropriate.
All median/MTCA	WAC 173-340-440	Applicable	Requires institutional controls where active cleanup measures (e.g. treatment) will not attain MTCA cleanup levels or where a cap is used to contain contaminants above MTCA cleanup levels.	No changes to this requirement.
Groundwater/MTCA	WAC 173-340-720	Applicable	Sets groundwater cleanup standards including points of compliance.	. No changes to this requirement.
Surface water/MTCA	/WAC 173-340-730	Applicable	Sets surface water cleanup standards including points of compliance.	No changes to this requirement..

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Soil/MTCA	WAC 173-340-740	Applicable	Set soil cleanup standards including points of compliance.	No changes to this requirement.
Hazardous Waste/Washington State Dangerous Waste Regulations	WAC 173-303	Applicable	Provides requirements to the treatment, storage or disposal of solid wastes which are dangerous or extremely hazardous to public health and the environment.	Hazardous waste is still generated as part of GWTP O&M. In 2009, Dangerous Waste regulation changed including updated manifest requirements. This is not relevant to the site.
Hazardous Waste/Resource Conservation and Recovery Act (RCRA)	40CFR 261 40 CFR 264 Subpart X 40 CFR 268	Relevant and Appropriate	Identifies to determine if waste is hazardous Provides requirements for the treatment of hazardous wastes Identifies land disposal restrictions	NAPL and treatment plant waste streams (sludges, tank bottom sediments, and spent carbon) are listed hazardous wastes generated as part of GWTP O&M. Changes have been made to 40 CFR 264 since the ROD. These include updates to the land disposal treatment standards for specific compounds. These changes do not affect the protectiveness of the remedy.
Hazardous Waste/RCRA	40 CFR §300.440	Relevant and Appropriate	States that wastes being treated or disposed off-site may only go to facilities that are in compliance with EPA's Off-Site Rule.	GWTP O&M procedures include obtaining affirmation that all facilities are in compliance with the Off-Site Rule.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Air Emissions/RCRA	40 CFR Subpart BB 40 CFR 264.1080 and 265.1080 Subpart CC	Relevant and Appropriate	Provides emission standards for equipment leak Provides air emission standards for tanks	Changes have been made to 40 CFR 264.1080 since the ROD. These changes do not affect the protectiveness of the remedy.
Liquid Discharge/Federal Waste Pollution Control Act/Clean Water Act	33 USC 1251-1376/40 CFR 100-149	Relevant and Appropriate	Requirements for discharge to marine surface waters and discharge of groundwater to surface water. This applies to the groundwater treatment effluent discharge into the Puget Sound. This requirement is relevant and appropriate to the discharge of groundwater to surface water at the mudline.	The groundwater treatment plant currently discharges to the Puget Sound. Treatment plant discharge meets surface water quality criteria. No changes to this requirement.
Dredge and Fill Discharge/Clean Water Act Dredge and Fill requirements: Sections 401 and 404	33 USC 401 et seq 33 USC 1413 40 CFR 230, 231 33 CFR 320-330	Relevant and Appropriate	Applicable to the discharge of dredged of fill material to waters of the U.S. The 404(b)(1) evaluation was completed for the construction of the sheet-pile wall.	No changes to this requirement. The sheet-pile wall is currently in-place. .

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Remedial Actions/Rivers and Harbors Appropriations Act	33 USC 403 33 CFR 322	Relevant and Appropriate	Establishes permit requirements for activities that may obstruct or alter a navigable waterway; activities that could impede navigation and commerce are prohibited. These substantive requirements are relevant and appropriate to remedial actions, such as construction of the sheet-pile wall and shoreline reconstruction.	The sheet-pile wall is currently in-place. No changes.
Liquid Discharges/National Pollution Discharge Elimination System (NPDES)	WAC 137-220	Applicable	Provides conditions for authorizing direct discharges to surface waters and specifies point source standards for these discharges. The NPDES standards are applicable to discharges to surface water by the groundwater treatment plant.	. The GWTP currently discharges into the Puget Sound. .The discharge meets surface water quality criteria.
Surface water/Washington State Water Quality Standards for Surface Waters	WAC 137-201A	Applicable	Establishes standards for the protection of surface water quality. The standards for marine waters are applicable to surface water.	Any changes do not affect the protectiveness of the remedy. Discharges from GWTP meet surface water quality criteria.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Sediment/Washington State Sediment Management Standards	WAC 137-204	Applicable	Establishes chemical concentration and biological effects criteria for Puget Sound sediments and are applicable such that discharges from the groundwater at the site do not cause exceedances of PAH and PCP standards in sediments.	This requirement is no longer applicable to this OU.
Groundwater/Safe Drinking Water Act/National Primary Drinking Water Regulations	40 CFR 141	Relevant and Appropriate	These standards were adopted by the State of Washington sets maximum contaminant levels (MCLs), which are the maximum permissible levels of contamination in drinking water based on the prevention of adverse health effects. Large portions of the upper aquifer at the site are non-potable due to high salinity levels. However, MCLs are relevant and appropriate to the lower aquifer, a potential source of drinking water.	MCLs related to this site have not changed since the ROD. .

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Air Quality/Clean Air Act Prevention of Significant Deterioration of Air Quality	40 CFR 52.21	Applicable	Provides provisions for the prevention of significant deterioration of air quality in any portion of any State where the existing air quality is better than the national ambient air quality standards (NAAQS). This requirement is applicable if the potential to emit exceeds 250 tons per year of more of any air pollutant subject to regulation under the Act.	The thermal treatment pilot study was completed in 2001. This requirement is no longer applicable to this OU.
Air quality/Clean Air Act Standards of Performance for New Stationary Sources	Soils and Groundwater ROD Page 61 40CFR 60	Applicable	Provides provisions for Small Industrial-Commercial-Institutional Steam Generating Units. This regulation provides limitations for particulate matter and sulfur dioxide emissions.	The thermal treatment pilot study was completed in 2001. This requirement is no longer applicable to this OU.
Air quality/Clean Air Act National Emission Standards for Hazardous Air Pollutants	Soils and Groundwater OU ROD Page 61 40 CFR 63	Applicable	Regulates specific categories of stationary sources that emit (or have the potential to emit) one or more hazardous air pollutants listed in this part. This requirement is applicable, if emissions will exceed the threshold levels for each pollutant.	The thermal treatment pilot study was completed in 2001. This requirement is no longer applicable to this OU.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Air Quality/Puget Sound Air Pollution Control Agency Regulation I	Soils and Groundwater OU ROD Page 61 WAC 137-400	Applicable	Establishes technically feasible and reasonable attainable standards that are generally applicable to the control and/or prevention of the emission of air contaminants. Specific provisions apply to the steam boil and treatment system.	The pilot system operated between 2002 and 2003. A new groundwater treatment system was completed in 2010. This requirement is no longer applicable to this OU.
Air quality/Puget Sound Air Pollution Control Agency Regulation III	Soils and Groundwater OU ROD Page 61 WAC 173-460-030(2)(b)	Applicable	Establishes acceptable source impact levels for toxic air pollutants emitted from new or modified sources to prevent air pollution, reduce emissions to the extent reasonable possible, and maintain such levels of air quality to protect human health and the environment. Applies to the steam boiler and treatment system if they emit a Class A or Class B toxic air pollutant into the ambient air.	The thermal treatment pilot study was completed in 2001. This requirement is no longer applicable to this OU.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Oil transfer/Oil Pollution Control Act of 1990 (federal)	Soils and Groundwater OU ROD Page 62 33 CFR 154	Applicable	Provides provisions for facilities transferring oil or hazardous materials in bulk. Applicable to the site which is anticipated to be receiving bulk shipment of fuel from a vessel with a capacity of 250 barrels.	The site no longer receives bulk fuel shipments. This requirement is no longer applicable to this OU..
Oil transfer/Oil Pollution Control Act of 1990 (state)	Soils and Groundwater OU ROD Page 62 WAC 137-180A,B,C, C	Applicable	Establishes minimum performance standards for oil transfer, storage and monitoring activities. Substantive requirements apply to the delivery of fuel from barges to the site.	The site no longer receives bulk fuel shipments. This requirement is no longer applicable to this OU.
All media/Federal Endangered Species Act of `1973	16 USC 1531 et seq.; 50 CFR 200, 402q	Relevant and Appropriate	The area around the site is potential habitat for threatened and/or endangered species. This requirement applies to any remedial action performed at the site.	No changes to this requirement since the ROD other than changes to species listing/delisting. These changes do not affect the protectiveness of the remedy.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
All media/U.S. Fish and Wildlife Coordination Act	16 USC 661 et seq.	Relevant and Appropriate	This act prohibits water pollution with any substance deleterious to fish, plant life, or bird life, and requires consultation with the U.S. Fish and Wildlife Service and appropriate state agencies. Established criteria include site selection, navigational impacts, and habitat remediation. These requirements are applicable for remedial activities on site.	No changes.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
All media/Construction in State Waters; Hydraulic Code Rules	RCW 75.20 WAC 220-110	Applicable	Hydraulic project approval and associated requirements for construction projects in state waters have been established for the protection of fish and shellfish. Substantive permit requirements are applicable to the construction of the sheet-pile wall. Technical provisions and timing restrictions of the Hydraulic Code Rules are also applicable to construction of the sheet-pile wall and shoreline modifications associated with habitat mitigation activities.	Impacts sheet-pile wall repair/replacement. Any changes do not affect the protectiveness of the remedy.
Shoreline Shoreline Management Act Coastal Zone Management Act Kitsap County Shoreline Management Program City of Bainbridge Shoreline Management Regulations	RCW 90.58, WAC 173-14 16 USC 1457 et seq. WAC 173-19-2604	Applicable	These statutes and regulations are applicable for the construction of the sheet-pile wall, which will be along the shoreline area of the site, and shoreline modifications associated with habitat mitigation activities.	The City of Bainbridge Island is in the process of updating their Shoreline Management Regulations. This change may affect any future sheet-pile wall repair/replacement work. However, any potential changes would not affect the protectiveness of the remedy.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Water wells/Minimum Standards for Construction and Maintenance of Water Wells	WAC 173-160	Applicable	This establishes minimum standards for water well construction. This requirement is applicable to monitoring well construction, steam injection well construction/action; and if EPA decides to install a water well for steam generation. This requirement also applies to decommissioning of wells	A water well was constructed as part of the pilot thermal treatment system. This water well is currently used as process water for the new GWTP. Changes to this requirement occurred in 2008 which added new provisions that require certification of certain drilling materials to protect groundwater quality. These changes do not affect the protectiveness of the remedy.
Steam injection wells/Underground Injection Program	Soils and Groundwater OU ROD Page 63 WAC 173-218	Applicable	This requirement is applicable to the steam injection wells necessary for thermal remediation.	The pilot thermal system ceased in 2003. This requirement is no longer applicable to this OU.
Solid Waste/Minimal Functional Standards for Solid Waste Handling	Soils and Groundwater OU ROD Page 63 WAC 173-304	Relevant and Appropriate	If thermal remediation is does not fully remediate surface soil in the Former Process Area to MTCA cleanup standards, then a contingency would be employed which may include a soil cap. This requirement would then be relevant and appropriate.	No changes to this requirement since the ROD. This requirement is no longer applicable to this OU.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Air emissions/General Regulations for Air Contaminant Sources	WAC 173-400	Applicable	Requires best management practices to be employed including covering stock piles, cleaning trucks prior to leaving the site, and monitoring air emissions. This is applicable during remedial action at the site	Stockpiles, if generated, are covered, and all trucks leaving the site are cleaned prior to leaving the exclusion zone. This requirement was updated in 2011. These updates bring the rule into compliance with EPA regulations including standards for excess emissions, major stationary sources located in nonattainment areas. These changes do not affect the protectiveness of the remedy.
Noise/City of Bainbridge Island Noise Regulations	Title 16 Environment, Chapter 16.16	TBC	Requires notification and coordination with the Office of Planning and Community Development regarding the construction .	No changes.

TBC – to be considered

West Harbor OU ARAR Analysis

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Soil/MTCA	WAC 173-340-740	Applicable	Set soil cleanup standards including points of compliance. Soil cleanup standards are to be achieved in treating and containing contaminant sources at the Former Shipyard.	Soil cleanup was completed. MTCA was revised in November 2007. Major changes included how cleanup levels for PAHs, dioxins, and PCB are determined. Soil cleanup levels for PAHs would be affected by this change. However, these changes do not affect the protectiveness of the remedy.
Hazardous Waste/Washington State Dangerous Waste Regulations	WAC 173-303	Applicable	Provides requirements to the treatment, storage or disposal of solid wastes which are dangerous or extremely hazardous to public health and the environment. These requirements apply to excavated sediments.	This standard applies to dangerous or extremely hazardous wastes generated related to current operations and maintenance. Any changes do not affect the protectiveness of the remedy.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Surface water/ Washington State Water Pollution Control Act Washington State Water Quality Standards	RCW 90.48 WAC 137-201	Applicable	Establishes standards for the protection of surface water quality. The standards for marine waters are applicable to discharges to surface water from sediment dewatering or solidification/stabilization processes. These requirements are also applicable to source control actions including activities to control stormwater, marine operations, and contaminated upland areas.	All remedial action has been performed at this site. This site is in the operation and maintenance phase. All surface water discharges from the site must comply with a NPDES permit. Any changes do not affect the protectiveness of the remedy.
Surface water/Washington State Hydraulic Code Rules	WAC 220-110	Applicable	Hydraulic project approval and associated requirements for construction projects in state waters have been established for the protection of fish and shellfish. Technical provisions and timing restrictions of the Hydraulic Code Rules are also applicable. These requirements apply, if fill or dredging activities will change the natural flow or bed of state waters.	All remedial action has been performed at this site. This site is in the operation and maintenance phase. Any changes do not affect the protectiveness of the remedy.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Liquid discharges/National Pollution Discharge Elimination System (NPDES)	WAC 137-220 WAC 137-220-120, 130	Applicable	Provides conditions for authorizing direct discharges to surface waters and specifies point source standards for these discharges. The NPDES standards are applicable to discharges to surface water from sediment dewatering or solidification/stabilization processes. These requirements are also applicable to source control actions including activities to control stormwater, marine operations, and contaminated upland areas.	All stormwater discharges and associated requirements are operating under a NPDES permit. Any changes do not affect the protectiveness of the remedy.
Sediment/Washington State Sediment Management Standards	WAC 137-204	Applicable	Establishes chemical concentration and biological effects criteria for Puget Sound sediments. These standards apply to remedial actions for contaminated sediments that do not meet the minimum cleanup level.	All remedial action has been performed at this site. This site is in the operation and maintenance phase. Any changes do not affect the protectiveness of the remedy.
Shoreline/ Shoreline Management Act Kitsap County Shoreline Management Program	RCW 90.58, WAC 173-19-2604	Applicable	These statutes and regulations are applicable to activities conducted within 200 feet of the shoreline (mercury hotspot removal).	All remedial action has been performed at this site. This site is in the operation and maintenance phase. Any changes do not affect the protectiveness of the remedy.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Dredge material/Puget Sound Dredge Disposal Analysis		TBC	Provides requirements and guidelines for evaluating dredged material, disposal site management, disposal site monitoring, and data management	All remedial work has been performed at this site. This site is in the operation and maintenance phase. This requirement is not relevant to this site.
Wetlands and Floodplains/Executive Orders 11990 and 11988	40CFR 6 App A	TBC	These orders were intended to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial uses of wetlands and floodplains.	All remedial action has been performed at this site. This site is in the operation and maintenance phase. Any changes do not affect the protectiveness of the remedy.
Edible seafood tissue/ U.S. FDA	21 CFR 110.110	TBC	Provides action levels for concentrations of mercury and PCBs for edible seafood tissue.	Health advisories are in effect warning of the consumption of seafood in this area. Any changes do not affect the protectiveness of the remedy.
Wetlands/EPA Wetlands Action Plan		TBC	Describes the National Wetland Policy and primary goal of "no net loss."	All remedial work has been performed at this site. This site is in the operation and maintenance phase. This requirement is no longer relevant to this site.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Surface water/Puget Sound Water Quality Management Plan	Element S-4	TBC	Relates to the confined disposal of contaminated sediments.	All remedial work has been performed at this site. This site is in the operation and maintenance phase. This requirement is no longer relevant to this site.
Liquid discharge/All Known, Available, and Reasonable Technologies (AKART) guidelines;	Elements P-6 and P-7	TBC	Provides guidelines for the development AKART guidelines and effluent limits for toxicants and particulates.	All remedial work has been performed at this site. This site is in the operation and maintenance phase. This requirement is no longer relevant to this site.
Surface Water/Federal Ambient Water Quality Criteria	40 CFR 131	TBC	No description in ROD.	All remedial work has been performed at this site. This site is in the operation and maintenance phase. This requirement is no longer relevant to this site.
Surface water/sediments Puget Sound Estuary Program Protocols		TBC	Applies to sample collection, laboratory analysis, and QA/QC procedures.	All remedial work has been performed at this site. This site is in the operation and maintenance phase. This requirement is no longer relevant to this site.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Surface water/Puget Sound Water Quality Management Plan	Element S-4	TBC	Relates to confined disposal of contaminated sediments.	All remedial action has been performed at this site. This site is in the operation and maintenance phase. More recent management plans established for the Puget Sound would not affect the protectiveness of the remedy.

TBC – to be considered

East Harbor OU ARAR Analysis

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Hazardous Waste/Washington State Dangerous Waste Regulations	WAC 173-303	Applicable	Provides requirements to the treatment, storage or disposal of solid wastes which are dangerous or extremely hazardous to public health and the environment. These requirements apply to excavated sediments.	Operation and maintenance. Any changes do not affect the protectiveness of the remedy.
Hazardous Waste/Resource Conservation and Recovery Act (RCRA)	40CFR 261 40 CFR 262 40 CFR 268	Relevant and Appropriate	Identifies how to determine if waste is hazardous Provides requirements for the treatment of hazardous wastes Identifies land disposal restrictions These requirements apply to excavated sediments	All work has been completed. This requirement is no longer relevant to this site.
Hazardous Waste/RCRA	40 CFR §300.440	Relevant and Appropriate	States that wastes being disposed off-site may only go to facilities that are in compliance with EPA's Off-Site Rule.	No wastes have been generated recently from this OU. This requirement is no longer relevant to this site.
Liquid discharges State Waste Discharge Permit Program	WAC 173-216	Applicable	Provides restrictions on certain discharges to publicly owned treatment works (POTW), if wastewater is discharged to a POTW. This is applicable, if the natural recovery portion of the remedy is modified.	Currently, no changes in the natural recovery portion of the remedy have occurred. This requirement is no longer relevant to this site.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Liquid discharges/National Pollution Discharge Elimination System (NPDES)	WAC 137-220	Applicable	Provides effluent limitations, water quality standards. This is applicable, if the natural recovery portion of the remedy is modified.	Currently, no changes in the natural recovery portion of the remedy have occurred. This requirement is no longer relevant to this site.
Habitat and Dredged and Fill Material/Clean Water Act Section 401 and 404	40CFR 230	Relevant and Appropriate	Requirements of 401 and 404(b)(1) are applicable to fill activities and dredging or excavation of contaminated sediments (for any excavated intertidal PAH hotspots). These requirements are intended to protect marine environments and prevent adverse effects on municipal water supplies, shellfish beds, fisheries (including spawning and breeding areas), wildlife, and recreational areas during dredging and any placement (e.g. capping) activities.	All fill activities have been completed. These requirements would apply to any future cap-repair work, EBS maintenance, or future in-water remedial actions. Any changes do not affect the protectiveness of the remedy.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Surface water/Rivers and Harbors Appropriations Act	33 USC 403 33 CFR 322	Relevant and Appropriate	This requirement is relevant and appropriate to fill activities and dredging or excavation of contaminated sediments (for any excavated intertidal PAH hotspots).These requirements are intended to protect marine environments and prevent adverse effects on municipal water supplies, shellfish beds, fisheries (including spawning and breeding areas), wildlife, and recreational areas during dredging activities.	All fill activities have been completed. These requirements would apply to any future cap-repair work, EBS maintenance, or future in-water remedial actions. Any changes do not affect the protectiveness of the remedy.
Surface water/ Washington State Water Pollution Control Act Washington State Water Quality Standards	RCW 90.48 WAC 137-201	Applicable	Establishes standards for the protection of surface water quality. The standards for marine waters are applicable to discharges to surface water from sediment dewatering, if natural recovery portion of the remedy is modified.	Currently, no changes in the natural recovery portion of the remedy have occurred. Any changes do not affect the protectiveness of the remedy.
Surface water/Washington State Hydraulic Code Rules	WAC 220-110	Applicable	These requirements are intended to protect fish by, e.g., placing limitations on the timing and duration of dredge/fill activities. These requirements apply, if fill or dredging activities will change the natural flow or bed of state waters.	All fill activities have been completed. These requirements would apply to any future cap-repair work, EBS maintenance, or future in-water remedial actions. Any changes do not affect the protectiveness of the remedy.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Sediment/Washington State Sediment Management Standards	WAC 137-2049	Applicable	Establishes chemical concentration and biological effects criteria for Puget Sound sediments. These standards apply to remedial actions for contaminated sediments that do not meet the minimum cleanup level.	No changes have been made to these standards.
Shoreline/ Shoreline Management Act Kitsap County Shoreline Management Program	RCW 90.58, WAC 173-19-2604	Applicable	These statutes and regulations are applicable activities conducted within 200 feet of the shoreline. The City of Bainbridge Island (then known as the City of Winslow) adopted these standards.	The City of Bainbridge Island is currently revising their Shoreline Master Program which is governed by the Washington State Shoreline Management Act. Potential changes may affect future work including shoreline modifications, stabilization, material placement activities, dredging and dredged material disposal. However, these changes would not negatively impact the protectiveness of the remedy.
Wetlands and Floodplains/Executive Orders 11990 and 11988	40CFR 6 App A	TBC	These orders were intended to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial uses of wetlands and floodplains.	All remedial work has been performed at this site. This site is in the operation and maintenance phase. Any changes do not affect the protectiveness of the remedy.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Dredged material/Puget Sound Dredged Disposal Analysis/Dredged Material Management Program		TBC	Provides requirements and guidelines for evaluating dredged material, disposal site management, disposal site monitoring, and data management	All remedial work has been performed at this site. This site is in the operation and maintenance phase. May apply to repair of cap if dredged materials are used. Any changes do not affect the protectiveness of the remedy.
Edible seafood tissue/ U.S. FDA	21 CFR 110.110	TBC	Provides action levels for concentrations of mercury and PCBs for edible seafood tissue.	Health advisories are in effect warning of the consumption of seafood in this area. Any changes do not affect the protectiveness of the remedy.
Surface water/Puget Sound Water Quality Management Plan	Element S-4	TBC	Relates to the confined disposal of contaminated sediments.	All remedial work has been performed at this site. This site is in the operation and maintenance phase. This requirement is no longer relevant to this site.
Liquid discharge/All Known, Available, and Reasonable Technologies (AKART) guidelines;	Elements P-6 and P-7	TBC	Provides guidelines for the development AKART guidelines and effluent limits for toxicants and particulates.	All remedial work has been performed at this site. This site is in the operation and maintenance phase. This requirement is no longer relevant to this site.

Medium / Authority	ARAR / Citation	ARAR Determination in the ROD	Standard Applied in ROD	Current Use / Changes
Surface Water/Federal Ambient Water Quality Criteria	40 CFR 131	TBC	No description in ROD.	All remedial work has been performed at this site. This site is in the operation and maintenance phase. This requirement is no longer relevant to this site.
Surface water/sediments Puget Sound Estuary Program Protocols		TBC	Applies to sample collection, laboratory analysis, and QA/QC procedures.	All remedial work has been performed at this site. This site is in the operation and maintenance phase. This requirement is no longer relevant to this site.
Surface Water/Federal Ambient Water Quality Criteria	40 CFR 131	Relevant and Appropriate	No description in ROD.	All remedial work has been performed at East Harbor OU. East Harbor OU is in the operation and maintenance phase. Relevant and Appropriate to discharges from GWTP into East Harbor. Any changes do not affect the protectiveness of the remedy.
Surface water/sediments Puget Sound Estuary Program Protocols		TBC	Applies to sample collection, laboratory analysis, and QA/QC procedures.	All remedial work has been performed at this site. This site is in the operation and maintenance phase. Any changes do not affect the protectiveness of the remedy.

TBC – to be considered

Region 10 Routing and Concurrence

Author:	H. Orlean	Date:	9/27/12
Addressee:			
Subject:	Wyckoff - Five Year Review		
File Location/Name:			

PROGRAM ADMIN REVIEW:

Name:						
Initials/Date:						

PROGRAM OFFICE CONCURRENCE:

Name:	Orlean	Brancfield	Sheldrake	Ordine		
Initials/Date:	9/27/12	9/27/12	9/24/12	9/27/12		

RA OFFICE CONCURRENCE/SIGNATURE:

Name:						
Initials/Date:						

cc(s) (include name, title, organization, mailing address, and email if PDF is required—attach a list if necessary)

bcc(s) (include name, title, organization, mailing address, and email if PDF is required—attach a list if necessary)

Mailing Deadline:		Certified Mail:	
FAX to:		FAX #:	

ADDITIONAL INFO/INSTRUCTIONS:

Filing Instructions:					
Program		Chrono.		Other	